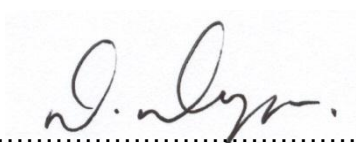


**An investigation into the impact of visual aids
in post-compulsory education
(Are text-based slides the optimum?)**

**Submitted by Nick Louis Napper to the University of Exeter
as a thesis for the degree of
Doctor of Philosophy in Education
in April 2014**

This thesis is available for Library use on the understanding that it is copyright material and that no quotation from the thesis may be published without proper acknowledgement.

I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

Signature:

Abstract

This study seeks insight into the use of visual aids in contemporary post-compulsory teaching. The importance of the study is linked to the large number of students who enter Higher Education; many of whom regularly receive lectures supported by visual displays which comprise textual summaries of a lecturer's speech.

This thesis comprises a two-part study and employs a mixed methods approach. The first part inquires into teachers' and lecturers' practice with regard to their visual aids, and the second compares the effectiveness of text, images and imagery displayed in support of a lecture.

The investigation into lecturers' practice found many post-compulsory teachers and lecturers had received no training in the design and use of visual aids during their initial teacher training. It is suggested this privation may underpin a de facto choice of projected text as a visual aid, the use of which is not clearly supported by contemporary models of memory and mental processing.

In a comparison of visual modalities, an increase in learner engagement was recorded for the display of carefully designed images, and also for directed imagery. No positive impact was recorded for text summaries of 50-64 words displayed concurrently with speech, although recall was improved when text was restricted to five words or fewer. The conclusion is drawn that the display of this modality without temporal pauses may offer limited educational advantage to students, and a method of planned apportionment of speech and text is proposed in which contemporary theories of memory and processing are taken into account. These observations have significant implications for a lecture environment in which such text summaries are often relied upon for visual support.

The findings of the thesis are combined to propose a principle of Visual Working Memory Utilisation (VWMU), upon which future research into visual aid design and use in post compulsory education might be based.

Contents

Abstract.....	3
Acknowledgements.....	14
Chapter 1 Introduction.....	15
1.1 Motivation for the thesis	15
1.2 Evolution of the research questions.....	19
1.3 Overview of the thesis	19
Chapter 2 What should lecturers do? Literature review	23
2.1 Introduction.....	23
2.2 Information readily available to teachers & lecturers	23
Visual aid literature.....	23
Popularist sources of visual aid guidance	27
2.3 What theory might inform visual aid design?	29
Cognitive Load Theory	29
Working Memory Theory	31
Dual Coding Theory	34
Cognitive Theory of Multimedia Learning.....	36
Integrated Model of Text and Picture Comprehension	37
Cognitive styles and learning styles	38
2.4 Images as an aid to learning.....	45
Images may not automatically support learning	48
2.5 Textual iteration of the spoken word.....	51
The Redundancy Effect.....	52
2.6 Depiction of abstract topics.....	64
2.7 Reality simulation and imagination	66
Imagery and learning	70
2.8 Discussion	74
2.9 Conclusion.....	75
Chapter 3 What do lecturers do? Literature review	77
3.1 Introduction	77
3.2 Setting the scene	77
3.3 Analysis of the technology	80
3.4 Ubiquity of text-based visual aids	84
3.5 Lecturers' knowledge and skills	86
3.6 Lecturer effect: Gesture and expression.....	94
3.7 Discussion	95
3.8 Conclusion.....	96

Chapter 4 What cultural influences might impact upon lecturers' practice? ...	99
4.1 Introduction	99
4.2 Images and language: A chequered relationship	99
4.3 Visual literacy in society	102
4.4 Visual literacy among teachers and lecturers	105
4.5 Initial Teacher Training	107
4.6 Discussion	109
4.7 Conclusion	110
Chapter 5 Methodological issues	111
5.1 Introduction	111
5.2 Selecting an appropriate research design	111
Mixed methods	115
5.3 Quality	117
Generalisability or transferability?	118
5.4 Ethics	120
5.5 Conclusion	125
Chapter 6 Methods employed	127
6.1 Introduction	127
6.2 Modalities exploratory study	127
Analysis of results	128
6.3 Lecturers exploratory study: Survey	128
Analysis of survey results	130
6.4 Modalities main study: Intervention study	131
Analysis of post-lecture questionnaires	132
Focus groups	134
Analysis of focus group data	140
6.5 Lecturers main study: Interviews	142
Analysis of interview data	144
6.6 Conclusion	146
Chapter 7 Modalities exploratory study	149
7.1 Introduction	149
7.2 The study	149
7.3 Results	154
Post-lecture evaluation	154
Recall after 14 days	155
Interview results	157
7.4 Discussion	157
Modality effects	157
Student preference	160
Lecturer style	161
Redundancy	162

Questionnaire response rate	163
Memory of an unseen slide	164
7.5 Recommendations for the main study	164
7.6 Conclusion	165
Chapter 8 Lecturers exploratory study	167
8.1 Introduction	167
8.2 The survey instrument	167
8.3 Results.....	170
Beliefs	170
Knowledge	171
Experience	171
Comparison by qualification	171
Comparison by environment	172
8.4 Discussion	172
8.5 Conclusion	176
Chapter 9 Modalities main study: A comparison of four interventions.....	177
9.1 Introduction	177
9.2 Research Design	177
Custom-made graphics (Custom-Graphics).....	180
‘Traditional’ PowerPoint (Trad-PPt).....	181
Minimalist text (Min-PPt)	182
Guided imagery (Guided-Imagery).....	182
Sample composition.....	184
Piloting	185
9.3 Intervention 1: Custom-Graphics	190
Short-term retention	190
Appreciation	192
Engagement and understanding	192
9.4 Intervention 2: Trad-PPt.....	196
Short-term retention	197
Appreciation	198
Engagement and understanding	199
9.5 Intervention 3: Min-PPt	201
Short-term retention	202
Appreciation	202
Engagement and understanding	203
9.6 Intervention 4: Guided-Imagery	205
Short-term retention	206
Appreciation	206
Engagement and understanding	207
9.7 Comparison of the four interventions	211
Recall of Values statements.....	211
Recall by individual Value	214
Participant appreciation.....	216

Recall and appreciation by professional registration	218
Engagement and affect	221
9.8 Discussion	226
Images are not necessarily equal in effect	226
Imagery and learning	226
9.9 Conclusion	228
Chapter 10 Lecturers main study: Interviews with teachers and lecturers.....	229
10.1 Introduction	229
10.2 Research design	229
Pilot	230
10.3 Results.....	234
10.4 Theme 1: Reasons for using visual aids	234
i) Aids to planning.....	234
ii) Lecturer prompts	235
iii) Pre-lecture information and aids to note-taking	237
10.5 Theme 2: Influence of presentation software	239
i) PowerPoint templates	240
ii) Ready-made backgrounds	241
10.6 Theme 3: Predominance of text.....	243
10.7 Theme 4: Influence of learning style theories	247
10.8 Theme 5: Initial Teacher Training in visual aid use	249
10.9 Responses to 'Possible reasons to use visual aids'	254
10.10 Discussion	255
10.11 Conclusion	255
Chapter 11 General Discussion	257
11.1 Introduction	257
11.2 Text as an adjunct to speech	257
11.3 Images and impact	262
11.4 Guided imagery as a visual aid.....	265
11.5 Lecturers' practice and student requirements	268
11.6 Visual aid guidance available to teachers and lecturers	270
11.7 A student-centred approach to text.....	274
11.8 A principle to optimise students' working memory in lectures	275
11.9 Conclusion	278
Chapter 12 Conclusion	279
12.1 Introduction	279
12.2 Main themes	279
Concurrent speech and text	279
Rationales for visual aid use	280
Utilisation of visual processing capacity	281

Research methodology	282
12.3 Limitations.....	282
12.4 Personal learning.....	285
12.5 Contributions.....	285
12.6 Implications for educational practice	286
12.7 Further research	289
References	291
Appendix 1 Modalities exploratory study: Slide sets.....	311
Appendix 2 Modalities exploratory study: Questionnaires	314
Appendix 3 Lecturers exploratory study: Questionnaire	316
Appendix 4 Modalities main study: Lecture topic	319
Appendix 5 Modalities main study: Event programme	320
Appendix 6 Modalities main study: <i>Custom-Graphics</i>	321
Appendix 7 Modalities main study: <i>Trad-PPt</i>	322
Appendix 8 Modalities main study: <i>Min-PPt</i>.....	322
Appendix 9 Modalities main study: <i>Guided-Imagery</i>	324
Appendix 10 Modalities main study: Post-lecture questionnaire	325
Appendix 11 Modalities main study: Post-lecture questionnaire G-Imagery..	326
Appendix 12 Modalities main study: Values retention criteria.....	327
Appendix 13 Modalities main study: Analysis of focus group transcripts	328
Appendix 14 Lecturers main study: Interview questions	330
Appendix 15 Lecturers main study: Supplementary question	331
Appendix 16 Lecturers main study: Responses to supplementary question .	332
Appendix 17 Lecturers main study: Analysis of interview transcripts.....	332
Appendix 18 Certificate of ethical research approval	335

	List of Figures	Page
Figure 2.1	Line graph with affective element (Holmes, 1984)	25
Figure 2.2	Dale's Cone of Experience as originally published (Dale, 1969)	27
Figure 2.3	Dale's Cone of Experience as displayed in ' <i>Principles of Teaching</i> ', Bloomsburg University (Pastore, 2003)	27
Figure 2.4	Relationship between working memory and long-term memory (Baddeley, 2003)	31
Figure 2.5	Dual coding theory (Paivio, 1979).	34
Figure 2.6	Use of a pictorial element in a symbol system (Schnotz, 2001)	35
Figure 2.7	Cognitive Theory of Multimedia Learning (CTML) (Mayer, 2005)	36
Figure 2.8	Integrated Model of Text and Picture Comprehension (ITPC) (Schnotz, 2005)	37
Figure 2.9	Section of monkey striate cortex indicating topographical isomorphic representation of object perceived (Tootell et al. 1982).	55
Figure 2.10	ITPC (Schnotz, 2005) applied to simultaneous presentation of speech and text (with non-active areas greyed out).	59
Figure 2.11	Comprehension of spoken and written language (Gazzaniga, Ivry & Mangun, 2009)	60
Figure 2.12	Representation of an abstract notion (Kirkwood, 1988)	65
Figure 2.13	Graphic organiser (Bligh, 2000)	72
Figure 4.1	Comparison of development of projection in entertainment and education	106
Figure 5.1	PowerPoint slides from lectures of differing epistemological standpoints.	113
Figure 7.1	Slide 3: <i>Trad-PPT</i> (left), <i>Net-Graphics</i> (right)	151
Figure 7.2	Slide 13: <i>Net-Graphics</i>	153
Figure 7.3	Slides 10 & 11: <i>Net-Graphics</i> ' <i>Surprising Broca</i> '	153

Figure 7.4	Slide 6: <i>Net-Graphics</i>	161
Figure 9.1	Slides shown as <i>Custom-Graphics</i>	180
Figure 9.2	Slides shown as <i>Trad-PPT</i>	181
Figure 9.3	Slides shown as <i>Min-PPT</i>	182
Figure 9.4	<i>Custom-Graphics</i> ; percentage of correct answers by Value	190
Figure 9.5	<i>Trad-PPT</i> ; percentage of correct answers by Value	196
Figure 9.6	<i>Min-PPT</i> ; percentage of correct answers by Value	201
Figure 9.7	<i>Guided-Imagery</i> ; percentage of correct answers by Value	205
Figure 9.8	Total Values recalled by modality.	211
Figure 9.9	Recall by modality: Value 1. <i>Put Patients First.</i>	214
Figure 9.10	Recall by modality: Value 2. <i>Our Staff Make a Difference.</i>	214
Figure 9.11	Recall by modality: Value 3. <i>Leaders that Lead and Listen.</i>	215
Figure 9.12	Recall by modality: Value 4. <i>Pull Together as One Team.</i>	215
Figure 9.13	Recall by modality: Value 5: <i>Strive for the Best.</i>	216
Figure 10.1	PowerPoint background used by <i>Tom</i> to subliminally suggest an ocean.	242

	List of Tables	Page
Table 2.1	Coding according to concreteness (Paivio, 1979)	64
Table 7.1	Immediate post-lecture responses	155
Table 7.2	14 Days post-lecture recall	156
Table 8.1	Beliefs about visual aids	170
Table 8.2	General knowledge of visual aids	171
Table 8.3	Lecturers' experiences	171
Table 8.4	Responses according to qualification	172
Table 8.5	Responses according to environment	172
Table 9.1.	The 'Organisational Values'	178
Table 9.2	Participant reactions: <i>Custom-Graphics</i>	192
Table 9.3	Participant reactions: <i>Trad-PPT</i>	198
Table 9.4	Participant reactions: <i>Min-PPT</i>	202
Table 9.5	Participant reactions: <i>Guided-Imagery</i>	206
Table 9.6	Recall by modality pairing	212
Table 9.7	Responses to appreciation questions by intervention with modes underlined	217
Table 9.8	Responses to Question 2 ' <i>Did the visual aids make the lecture more interesting?</i> ' by pairings involving Trad-PPT	217
Table 9.9	Participants by registration status	219
Table 9.10	Recall scores by registration status	219
Table 9.11	Question 2: 'Did VAs make lecture more interesting?' by registration status	220
Table 10.1	'Possible functions of pictures in prose' (Levin, 1981)	238

Acknowledgements

I am very grateful to my first supervisor Rupert Wegerif who has provided wisdom and critical appraisal throughout, and has been instrumental in broadening my outlook toward educational research, and to philosophy in general.

I am also very grateful to my second supervisor Judith Kleine-Staarman who has provided advice and commentary on my writing which has complemented that of my first supervisor. Her pragmatic approach has encouraged me enormously.

I would like to thank my employing organisation for allowing me to undertake the Modalities studies under its auspices.

I would like to thank Mary Napper for her support, her patience and for reading my proofs, and also Sally Napper, who impressed upon me the worthiness of combining persistence with intellect.

Chapter 1 Introduction

1.1 Motivation for the thesis

During my initial teacher training in the 1980s I was required to demonstrate competence in the use of an overhead projector (OHP), with which I was expected to reveal text one line at a time, concurrently with my speech. At the time, I was uncertain how this technique might assist my mature students, and I have remained curious with regard to how text might function as visual support for learning ever since. More recently I have questioned how images assist learning for older students, because as Kress & Van Leeuwen (1996) have noted, by the time students reach post-compulsory education their textbooks have largely ceased to include illustrations on the presumption that learners are able to create their own internal representations.

In the second decade of the 21st century, visual displays which were once provided by blackboards, dry-wipe boards and OHPs are frequently delivered by digital projection. Contemporary combinations of computer graphics software and associated projectors are able to display an almost infinite variety of visual images and effects, the only limitations of which are the resources and imagination of the creator (Braden, 1994). The ubiquity of this medium is such that students who enter post-compulsory education in the United Kingdom may expect many of their lectures to be accompanied by illustrations which have been created digitally.

Yet despite such technologically versatile equipment becoming the norm, some researchers have found student disaffection with lectures to be linked to the provision of visual support in lectures. For example, Mann & Robinson (2009) found a contributory cause to such dissatisfaction to be the way in which Microsoft PowerPoint presentation software is utilised. Other researchers have recorded similar findings, in which criticisms relate directly to the use of visual aids in lectures (see for example, Apperson, Laws, & Scepansky, 2006; Bartsch & Cobern, 2003).

The numbers of students who enter Higher Education (HE) in the UK each year is in excess of 310, 000 (Bollington, 2012), and a further 580,000 undertake workplace based learning which lead to a qualification (Evans, 2012), of whom many receive lectures supported by a digital presentations. If the findings of the researchers cited above are at all generalisable to the wider post-compulsory student population, many

thousands of learners may regularly receive visual support which is less than satisfactory from a student viewpoint. In addition to the above, evidence exists that visual aids have produced dissatisfaction among students in the education fields of business (Burke, Ahmadi, & James, 2009; James, Burke, & Hutchins, 2006); medicine (LaPorte et al., 2002; Ricer, Filak, & Short, 2005), and nursing (Driessnack, 2005).

The factors which have contributed to these findings remain unclear because information regarding the design and educational purpose of the displays in question is frequently absent from research reports; their detail is often limited to criticism of the display of text from which some lecturers reportedly read aloud (see for example, Apperson et al., 2006; Kunkel, 2004). The pedagogical functions and learning outcomes which underpin lecturers' use of visual aids are not widely reported, and there is a resultant lacuna of data which might inform investigations in this area. This thesis aims to inform this lacuna by means of an inquiry into the content of contemporary teachers' and lecturers' visual aids, and also into the rationales which underlie their choices in visual aid design.

Although detail which relates to content is frequently absent in the literature, limited references appear which describe lecturers reading aloud to their students, and to the transference of text from acetate to digital media, and these suggest the choice of text as a visual aid may be common. This observation led to the development of my first research question which inquired into the efficacy of this modality, as it is unclear from the literature what pedagogical function an iterative display of text might have during a lecture. Some of the research articles do address the content of visual displays, but such reports are mainly based on the outcomes of laboratory-based experiments in which learning from computer-based learning modules has been investigated.

This thesis also inquires into what visual aid forms other than text might be used in support of abstract lecture topics, because much of the research literature to date has concentrated on depictions of mechanical or anatomical systems on paper (see for example, Dwyer, 1978), or on illustrations contained in books (see for example, Levie & Lentz, 1982; Levin, 1981). Since the period in which these studies were undertaken, a significant amount of research has been published which might also

inform visual aid creation, in particular a prolific output of research into the efficacy of visual modalities in the setting of online learning undertaken by Mayer (see for example, Mayer, 2010, 2005b; Mayer & Gallini, 1990; Mayer & Sims, 1994), and a significant body of research into mental imagery undertaken by Kosslyn (see for example, Kosslyn, 1980, 2005; Kosslyn & Thompson, 2000, 2003). It is important to note that many of these studies have not involved live synchronous teaching environments.

Despite the availability of such research literature, which has some relevance to visual aid use, guidance which informs the creation of visual support in lectures appears to be sparse. For those wishing to provide visual support for learners, readily available advice such as that gleaned from Internet searches is somewhat capricious; and includes suggestions to use 'relevant images' (Atkinson, 2005a), and to provide 'pictures' for 'visual learners' (Smith, 1998). Such advice is often based on popularist psychological theories such as Visual-Auditory-Kinaesthetic (VAK) theory (Sharp, Bowker, & Byrne, 2008), and Adesope & Nesbit (2012) conclude teachers have little empirical evidence or associated guidance with which to inform their practice.

In view of the lacunae cited above, this thesis seeks to acquire insight into how lecturers might optimally utilise the visual medium. As part of this inquiry, two modality studies are undertaken in which different methods of readily available visual stimulation are compared for their efficacy in supporting a lecture. The overall aim is to produce guidelines for the optimal use of visual aids in post-compulsory education. This thesis therefore has important practical applications, and it presents findings which are relevant to large numbers of teachers, lecturers and their students.

The research paradigm employed is mixed-methods, and was selected in order to provide the richest data from the enquiry (Mackenzie & Knipe, 2006), and also in order to produce results which may be acceptable to readers aligned to a single paradigmatic stance (Creswell & Plano Clark, 2007). The choice of methodology is discussed in detail in Chapters 5 and 6.

Terminology

The term **teacher** used throughout this thesis to refer to teachers and trainers of post-16 learners in work-based learning, and the term **lecturer** is used to refer to those employed in a teaching role in either a University or College of Further Education (FE).

The term **visual aid** is employed to describe an image displayed on a screen during a live lesson or lecture in accompaniment to a teacher or lecturer's speech.

Microsoft PowerPoint is by no means the only presentation or educational display software available, however most published studies refer to the digital display medium by the proprietary term '*PowerPoint*'; similarly, many lecturers refer to their completed visual aid sets as '*PowerPoints*'. I have chosen to maintain the convention in this thesis, and use the term **PowerPoint** to describe digital visual displays. It should be noted that the visual aid designs and practice investigated in this thesis would have remained essentially unaffected by the employment of alternative presentation software marques, such as Apple Keynote.

Exclusions

Language learning is not included in this thesis due to the visual impact of new word forms when displayed in a language-learning environment (Diao & Sweller, 2007). The value of visual text displays to students for whom English is not their first language is discussed in Chapter 10.

Video is not included, because I believe this medium, which often combines both spoken language and complex moving images, is sufficiently multifaceted to warrant investigation as a modality in its own right.

Online learning and the role of visual aids therein are not included because this inquiry is concerned with the use of visual aids in a 'live' teaching environment, and this thesis does not seek to contribute to the debate around images displayed in asynchronous online learning. Nonetheless, the functionality of images used in e-learning programmes has received much attention over the last 20 years and offers peer-reviewed data which might inform the wider images-in-learning debate, and many of such reports are referred to in this thesis.

Interactive whiteboards and associated software feature in a body of research which investigates their use in primary education. These devices are not included in this thesis because their predominant use for teaching young children in an interactive setting situates this medium in a different context.

1.2 Evolution of the research questions

One research question provides a foundation for this thesis; it concerns the effectiveness of text as a visual aid for post-compulsory learners. This leads to a secondary question with regard to viable alternatives; in particular the visual support of topics which are abstract in nature. As the thesis developed, the literature review suggested text-based visual aids might be limited in their impact, and further research questions were added which broadened the inquiry to include images and mental imagery. The guidance received by teachers and lecturers in their initial training, and the impact of wider societal influences were also considered.

Five questions emerged following an extensive literature review:

- What effect does the simultaneous provision of speech and text have in post-compulsory class and lecture room environments?
- What support can visual aids provide for an abstract topic beyond text?
- Can a visual modality support learning without the provision of ‘something to look at’?
- How do teachers and lecturers in post-compulsory education design and use visual aids?
- What factors influence teachers’ and lecturers’ use of visual aids?
- What forms of visual aid should teachers and lecturers of post-compulsory learners use?

Whilst it is clearly beyond the scope of an individual thesis to provide specific advice for the visual support of all topics taught in post-compulsory learning, an overarching aim is to develop principles which might inform the visual aid practice of teachers and lecturers.

1.3 Overview of the thesis

The thesis follows two complementary themes; the first of which inquires into the nature of teachers’ and lecturers’ visual aid practice. A second concurrent theme investigates how the visual medium impacts upon the capacity of post-compulsory

students to assimilate and process new information. The two themes combine in the general discussion chapter to consider how the visual medium might best be employed in lecture and classroom-based teaching for post-compulsory learners, and recommendations for future research are made.

Chapter 2 reviews the literature on how learners process new information, with specific regard to the concurrent provision of speech and visual stimuli. It examines five established models of mental processing and considers their application to a teacher or lecturer-led learning environment. Cognitive styles and learning styles are brought into the debate, and consideration is given to the way in which this field informs visual support for learning; with regard to published research and also to popularist literature.

Chapter 3 presents a critical appraisal of the literature which reports investigations into visual aid practice in post-compulsory education, much of which concerns undergraduate education in English-speaking universities. It analyses the impact of emerging technologies on the design and use of visual support in lectures, and the degree to which these developments have influenced lecturers' practice.

Chapter 4 examines the prevalence of visual literacy in society, and its influence upon teachers and lecturers in view of a cultural attitude which has, at times, regarded images as unworthy of an educated mind. The chapter also considers the impact of initial teacher training upon visual aid practice.

Chapter 5 describes methodological issues encountered in the design of this study. It considers opposing paradigmatic views, including that of an a-paradigmatic stance, and analyses which methodology might provide the richest data whilst maintaining a broad appeal to readers and an optimal level of transferability.

Chapter 6 explains the choice of methods employed in the quantitative and qualitative studies undertaken in this thesis. It details the approaches used in the two exploratory studies and the two main studies which follow. The chapter provides rationales and details of the methods of analysis employed.

Chapter 7 presents the Modalities exploratory study which examines the influence of two visual modalities on retention, when used independently in support of two lectures with similar spoken content. The visual modalities are a 'traditional' bulleted

text summary, and images acquired from an Internet image search, which are often recommended as an alternative to text (Atkinson, 2005a). Recall test results and learner appreciation ratings are compared and analysed by modality. The findings inform the design of the Modalities main study reported in Chapter 9.

Chapter 8 presents the Lecturers exploratory study in which teachers' and lecturers' visual aid practice was investigated by means of a survey. A paper questionnaire inquired into their beliefs, knowledge, and experiences with regard to visual aid use. Results are analysed, and compared according to respondents' main teaching qualification. The findings of this survey inform the Lecturers main study reported in Chapter 10.

Chapter 9 presents the Modalities main study which involved the attendance of 370 public service employees at mandatory lectures. A comparison of case studies was undertaken in which four different visual modalities were displayed in support of common lecture content. The modalities employed were: custom-made graphics which were carefully designed to create optimum affect; 'Traditional' PowerPoint bulleted text summaries of lecture content; minimalist text which comprised a maximum of five words, and guided imagery in which participants were given specific instructions to create mental images. The results were analysed with regard to the modality impact on recall, on learner appreciation, and on affective engagement with the lecture topic.

Chapter 10 describes the Lecturers main study in which a series of interviews were undertaken with a sample of 33 education professionals who comprised work-based teachers and university lecturers. 19 of the university lecturers were employed in initial teacher training or postgraduate education studies. The chapter analyses the interview transcripts, and seeks themes and insight with which to address the lacuna in the literature relating to lecturers' practice identified in Chapter 2.

Chapter 11 examines the results of the four studies undertaken in this thesis and offers interpretations of the findings. It analyses the degree to which visual aids are designed to support lecturers, and how much to support students. The chapter considers how text might be used as a visual aid to optimal effect, and also proposes a guiding principle on which to base the use of visual aids in general. Finally it

recommends further research into the ITT curriculum with a view to inclusion of the visual modality in teacher training.

Chapter 12 draws together the main contributions of this thesis and summarises its implications for practice. Areas for future research are proposed.

Chapter 2 What should lecturers do? Literature review

2.1 Introduction

This chapter reviews the literature which might inform teachers and lecturers who wish to design visual aids for their lessons and lectures. It analyses advice available from research literature, Internet sources, and from popular educational literature. Also considered is guidance provided in the literature which relates to cognitive styles and learning styles.

Three well established theories of memory are considered on which visual aid design might be based; working memory theory, cognitive load theory and dual coding theory, and two further contemporary theories of learning are included. The chapter specifically seeks literature which addresses the use of text as a visual aid. Finally, the validity of imagery is considered as an alternative to projected images, and recommendations are proposed for the main study.

2.2 Information readily available to teachers & lecturers

Visual aid literature

Many books are available which offer guidance for the creation of visual support for business presentations. Their covers are emblazoned with evocative titles such as *Beyond Bullet Points* (Atkinson, 2005a), *Wake 'em Up* (Antion, 1999), *Create High-Impact Business Presentations* (Kupsch & Graves, 1998), *High Impact Presentations* (Bowman, 1999), *Presenting to Win* (Weissman, 2003), *Powerful Presentations* (Ehrenborg & Mattock, 2001) and *Resonate* (Duarte, 2010). As their titles suggest, these books are aimed primarily at persuasion and influence in the world of commerce. Although they contain advice which is likely to be of benefit to many teachers and lecturers, most are based on the experiences and personal viewpoint of the authors rather than peer-reviewed research, and it is by no means certain that professional educators would identify with the model of a polished business presentation.

Books for teachers and lecturers

In reviewing the literature I was able to find only one book written specifically for teachers about visual learning support; *Graphics for Learning: Proven Guidelines for Planning, Designing, and Evaluating Visuals in Training Materials* (Clarke & Lyons, 2004). This volume is published in America and is not widely available in university

libraries; I conducted a search using the National, Academic, & Specialist Library Catalogue (Copac) in 2011 and found only 4 copies to be available in the UK. Its rarity may be related to the fact that a large proportion of the text relates to the illustration of e-learning programmes. Surprisingly, bearing in mind its subject matter and also the importance attributed by Levin (1981) to illustrations in increasing the sales of a book, all of Clarke & Lyons' (2004) illustrations are printed in greyscale. I contacted Ruth Clark (co-author) by e-mail and asked her the reason for this. She informed me the restriction of colour had been imposed by the publisher in order to reduce costs (R. Clark, personal communication, September 30, 2011).

The high selling *Evidence Based Teaching* (Petty, 2009) contains some advice for teachers regarding the use of visual aids; although of its 367 pages, only 19 are devoted to the visual medium, and these are primarily concerned with the creation of graphic organisers. Less well known volumes such as *Visual Communication* (Lester, 1999), *Creating Graphics for Learning and Performance* (Lohr, 2003) and *Instructional Media and Technologies for Learning* (Heinich, Molenda, Russell, & Smaldino, 2002), are comprehensive resources, although as with *Graphics for Learning* (Clarke & Lyons, 2004), they are not widely available in the UK.

Visual representation of data

The visual display of data has a rich history which originates in the charts and graphs of Playfair (1801) and Minard (1869), and is continued in 21st century by McCandless (2010) and Rosling (2011). Despite this robust lineage, visual creations which combine the creativity of a graphic artist, the coherent data of a statistician, and the pedagogical skills of a teacher, are uncommon. Tufte (1983, 1990, 1997) has written extensively on the communication of data through the visual medium, although he is perhaps more widely known for his criticism of PowerPoint (Tufte, 2006). Tufte's books (see for example, *The Visual Display of Quantitative Information* (Tufte, 1983) and *Envisioning Information* (Tufte, 1990)), provide a level of detail and complexity which requires commitment on the part of the reader in order to absorb the key messages, and as such, they are perhaps less likely to be accessed by time-pressed lecturers. Lengler & Eppler (2007) offer an online *Periodic Table of Visualisation* in which a series of visualisation methods are laid out in the form of the Periodic Table. It contains six categories of visualisation, 'Data', 'Information', 'Concept', 'Metaphor', 'Strategy', and 'Compound', which offer a total of 100 types of visualisation, although

it is uncertain how well this facility is known in the education world, as it is aimed primarily at the communication of data in the commercial arena.

Messaris (1994) describes how visual displays such as graphs and bar charts may include abstract representations as well as representational information, and allow viewers to draw on real-world experiences of juxtapositions of objects, slopes and surfaces. This effect may have negative consequences however, as described in an example provided by Ainsworth (2006), in which learners interpreted a velocity time graph of a cyclist iconically, reading an inverted U shaped as representing a hill. This accords with the findings of Kozhevnikov et al. (2002) in which high-spatial visualisers were found to correctly interpret graphs as abstract representations, whereas low-spatial visualisers tended to interpret them as pictures.

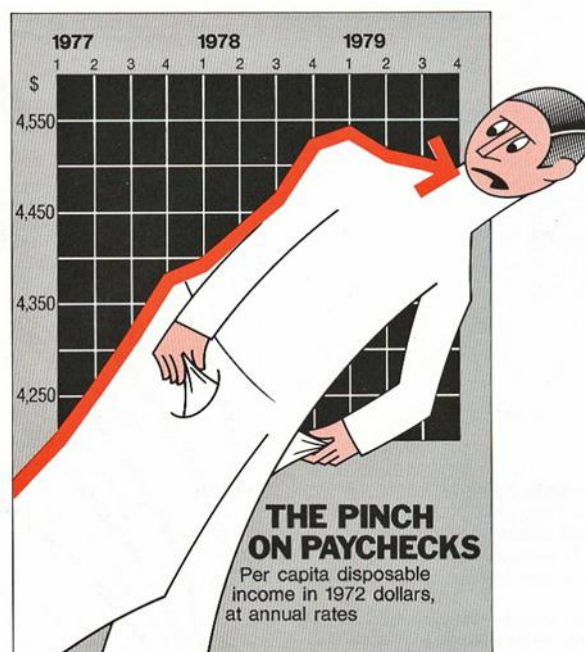


Figure 2.1. Line graph with affective element (Holmes, 1984)

A Gestalt interpretation may be deliberately utilised, as illustrated by Holmes (1984) in Figure 2.1, in which a line graph has been adapted to become part of the silhouette of an individual adversely affected by the trend illustrated in the display. This technique would presumably resonate to some degree with both high-spatial and low-spatial visualisers; as it combines an image and an abstract representation. However, production of this form of illustration requires a degree of artistic skill; as do many of the techniques for the creation of visually appealing charts and diagrams suggested by Holmes (1984). It is interesting to note that in the 19th century, teachers were required to demonstrate illustrative competence in the use of a blackboard (Robinson, 2004), although it is unclear whether any such requirement exists in contemporary teacher education. The issue of teachers' visual creative skills is addressed in Chapter 4.

Diagrams

A body of published research exists around the use of diagrams in the physical sciences. For example, Dwyer (1973, 1978, 1984) undertook many investigations into the effectiveness of visual representations of blood flow through the human heart, and Mayer and colleagues have published a significant body of work concerning the use of diagrams in computer-based learning, such as the mechanisms of hydraulic pumps, braking systems, alveolar exchange, and lightning (Mayer & Gallini, 1990; Mayer, Heiser, & Lonn, 2001; Mayer & Johnson, 2008; Mayer & Sims, 1994).

The representation of a scientific principle by means of a diagram is an established practice with an associated methodology. For example, Alley (2013) offers simple advice in support of the delivery of scientific presentations in the form of his 'Assertion-Evidence' model; namely that a lecturer first makes an assertion, then provides some visual evidence to support the assertion in the form of a chart or diagram.

However, HE often involves the teaching of abstract topics (Laurillard, 2002) which cannot easily be depicted, and the use of visual aids to support understanding of abstractions in a teaching environment is not well defined in the literature.

Nonetheless, Laurillard (2002) notes that concepts need to be grounded in experience and practice before they can be abstracted, and such knowledge,

'has to be...represented formally to become generalisable and therefore more generally useful' (Laurillard, 2002, p. 16)

The notion that such a representation might be attained through use of a visual medium is investigated in this thesis.

For a teacher or lecturer who is not involved in the visual arts, or who does not have a personal interest in the visual modality, the limited availability of supporting information may result in the primary influence on their practice being the visual aid displays modelled in their own teacher training, as it has been observed that many teachers tend to teach the way in which they were taught (Vallance & Towndrow, 2007). Another further source of information with regard to the use of visual aids can be found online and in popularist literature, and these are considered in the following section.

Popularist sources of visual aid guidance

For a teacher or lecturer who wishes to create visual aids for their lessons and lectures, guidance can readily be found by conducting an Internet search. However, in the online environment, advice of questionable provenance is often presented as received wisdom, and may be masked by association with otherwise reputable sources such as academic websites and commercially published literature. Folk-beliefs such as the notion that humans use only 10% of their brains have long been discredited (Beyerstein, 2004), yet a book aimed at teachers and still in print in 2013;

Accelerated Learning (Rose, 1985), informs its readers the amount of their brains used is 'less than 10%' and is actually 'nearer to 4%' (Rose, 1985, p. 5). Rose (1985) suggests teachers might increase this proportion by the display of visual aids for their learners.

A frequently cited source of data is *Dale's Cone of Experience* (Dale, 1969), yet the rendition provided is often an aberration of Dale's original concept. Edgar Dale

created a hierarchical model which defined degrees of immersion on the part of a learner, each step of which might increase the richness of their learning (Figure 2.2). As can be seen, Dale (1969) included no figures in his diagram, however this has not prevented others from adding data to the model whilst crediting their addition to Dale;

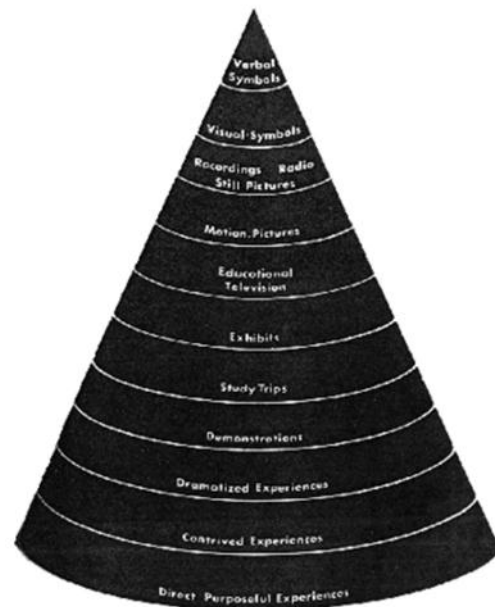


Figure 2.2 Dale's *Cone of Experience* as originally published (Dale, 1969)



Dale's Cone of Experience

Figure 2.3. Dale's *Cone of Experience* as displayed in 'Principles of Teaching', Bloomsburg University (Pastore, 2003)

despite such figures having been exposed as a myth in the 1970s (Dwyer, 1978). For example, Pastore (2003) adds a 10%-90% continuum to the model on the teaching resource webpage of Bloomsburg University (Figure 2.3), and falsely attributes it to Dale. Garnett quotes a similar set of figures in a book aimed at teachers; *Using Brainpower in the Classroom: 5 Steps to Accelerate Learning* (Garnett, 2005); on the back cover he assures the reader that he is an experienced teacher and trainer, and has '*applied these principles in over 500 schools across Britain*' (Garnett, 2005).

In the business world, the so-called 'Weiss-McGrath Study' is widely cited as a volume which provides evidence of the benefits brought about by the employment of visual aids. A 'Google' Internet search returns over 750,000 results for 'Weiss-McGrath', and results produce a variety of claims attributed to the study and which suggest a threefold increase in retention of learning may be brought about by the use of visual aids. There exists a grain of truth in this myth as the names are genuine; Weiss and McGrath were co-authors of a book on communication for engineers titled *Technically Speaking* (Weiss & McGrath, 1963). However their claims for the impact of visual aids were based on an unreferenced assertion that '*one study showed*' such an increase in retention (Weiss & McGrath, 1963, p. 78). Anecdotal comments such as those of Weiss and McGrath have become part of what Byrne (1993) describes as 'Snark syndrome' after the Lewis Carroll poem *The Hunting of the Snark*, in which one of the characters claims, 'What I tell you three times is true'. Byrne notes such claims are repeated time and again until they become part of the received wisdom in the field (Byrne, 1993).

One would hope professional teachers and lecturers who seek information to improve their practice would not be seduced by comments as unsupported as 'one study showed', or data which on reflection could not reasonably apply to the all-encompassing range of learning situations claimed. Yet reliable and accessible guidance with which to inform visual aid design is not easily obtainable. Nonetheless, theories exist in the literature which, although they are not often presented in a form which relates directly to visual aid creation, may provide a basis for their design and use, and these are discussed in the next section.

2.3 What theory might inform visual aid design?

In the 19th century an enthusiastic author described the placement of a blackboard at the front of a classroom to be, '*as effective as doubling the number of teachers and school hours*' (Bumstead, 1841, p. 3). This statement may be interpreted as more than simple rhetoric, in that it proposes a significant increase in learning might be brought about by the addition of a visual medium to the spoken word during a lesson. In the mid-20th century McLuhan (1964) suggested that technological advances in media which had not previously been possible, represented extensions to human senses. If notions such as those of Bumstead (1841) and McLuhan (1964) can be borne out, the utilisation of modern visual media should afford an increased efficacy and potency to lessons and lectures.

In the absence of accessible and evidence-based guidance on the design and use of visual aids, teachers and lecturers may look to established theories to inform their choices. Chabris, Kosslyn, Tergan, & Keller (2005) propose a 'Representational Correspondence Principle' in which they suggest that in order to be effective, visual aids should depict information the same way as that of our internal representations. To this end, the following section examines how visual aid creation and use might be informed by three established cognitive theories; working memory theory (WMT), cognitive load theory (CLT) and dual coding theory (DCT).

Cognitive Load Theory

One of the roles of a lecturer is to encourage thought and increase capacity for holding new ideas by minimising working load (Bligh, 2000). Cognitive Load Theory (CLT) (Chandler & Sweller, 1991) supports this aim by relating working memory capacity to learning, and predicting learning outcomes by taking into account the capabilities of learners' cognitive architecture (Plass, Moreno, & Brunken, 2010), and is playing an increasing role in educational research literature (de Jong, 2010). As with working memory theory described below, CLT suggests the amount of processing which is able to occur in verbal and visual channels at any one time is limited; consequently if learning content is not carefully designed, the student may be either mentally overloaded or under-stimulated.

Sweller, van Merriënboer, & Paas (1998) describe three forms of cognitive load; *intrinsic*, *extraneous*, and *germane*. *Intrinsic load* is imposed by the nature of the

learning itself; *extraneous load* is determined by instructional design, and *germane load* is determined by instructional design which aids the formation of schemas in long-term memory. Chandler & Sweller (1991) found that visual aids are not all equally helpful to learners. For example, an increased demand upon mental processing capacity may be created by diagrams in which the supporting text is positioned at the base, due to a requirement for the reader to hold fresh information in working memory whilst shifting attention from the description to the diagram.

In the arena of computer-based learning, the presentation of text concurrent with narration has been found to create a negative impact on learning (see for example, Chandler & Sweller, 1991; Mayer & Gallini, 1990; Mayer et al., 2001; Mayer & Moreno, 2002). A consensus which emanates from these studies is that the combination of a diagram, narration and text presents an unnecessarily high load on the learner, due to a 'split attention effect' (Chandler & Sweller, 1991). In such a situation a negative impact may be created by placing a demand on a learner to hold textual information in working memory while transferring attention to another visual locus, such as when moving from text to a drawing as described above. This has implications for the practice of lecturers who wish to speak whilst text and an image are displayed together on a single slide; in this scenario the cognitive load may be greater than that imposed by presentation of an image alone. In such a situation, the display of a visual aid might increase, rather than decrease cognitive load.

The scenario described above does not suggest that cognitive load should be reduced to a level in which students are 'spoon-fed', and counsel to avoid the creation of learning tasks which are overly simple is provided by Sweller et al. (1998). They found that although unhelpful (and thus extraneous) cognitive load is likely to be detrimental to learning, the application of germane cognitive load can aid retention by encouraging a learner to actively process the material. In the context of the visual support of learning, CLT suggests that extraneous load may be reduced and germane load added by display of a visual representation which is pedagogically purposeful. Sweller et al. (1998) suggest intrinsic load is fixed and cannot be altered; however it is feasible that intrinsic load might be spread between the two sub-systems of working memory, and thus be effectively reduced by sharing processing between auditory and visual modes. Thus the application of CLT to the design of visual aids may result in what Ainsworth refers to as '*computational*

offloading' (Ainsworth, 2006, p. 185). This notion is discussed in the section which describes working memory theory below.

A criticism of CLT is that its definitions of extraneous and germane loads depend on each other (Brunken, Plass, & Moreno, 2010). Judgement of such demands are usually made after observing the results of studies; i.e. if learning is shown to increase, extraneous load is interpreted to have been minimal and germane load optimal; conversely, if learning is found to have decreased, extraneous load is judged to have been present. Thus it is possible to apply the theory to nearly every learning situation (de Jong, 2010). Clark & Clark (2010) note that researchers have yet to find a reliable way to measure cognitive load, because a significant problem is encountered in attempting to differentiate between germane and extraneous load. Brunken et al. (2010) observe that CLT also lacks a theoretical interpretation with regard to how it is processed in the human cognitive system. Findings from functional magnetic resonance imaging (fMRI) studies appear to confirm that excessive cognitive load represents extraneous load; for example Callicott et al. (1999) found increased working memory load to be associated with declining accuracy in tasks.

Working Memory Theory

Working memory theory (WMT) proposes the resources of the whole human brain are not simultaneously available to the conscious mind; processing power is limited to a finite amount at any one moment. This concept was originally named 'primary memory' (James, 1890), and later 'immediate memory' (Miller, 1956). In the 1970s Baddeley introduced the term 'working memory'

(Baddeley & Hitch, 1974), which describes the processing capacity available for the

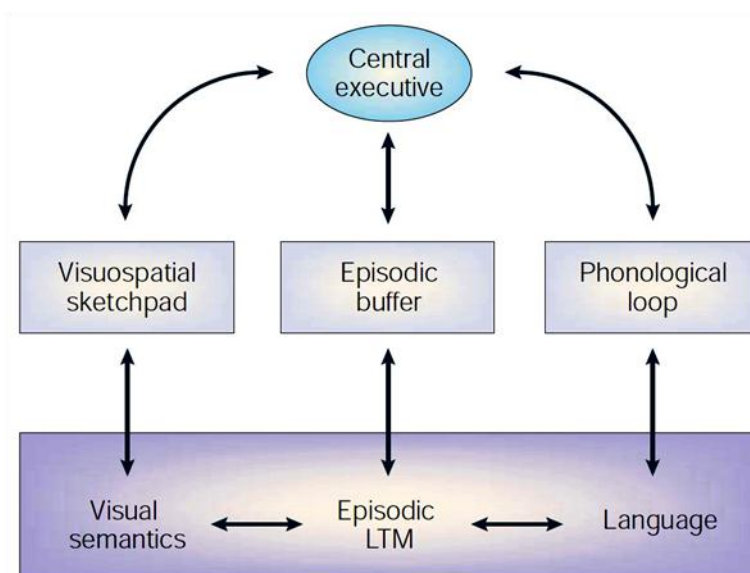


Figure 2.4 Relationship between working memory and long-term memory (Baddeley, 2003)

temporary storage and manipulation of information (Baddeley, 2003a). Working memory allows us to think, to manipulate, and to deal with concepts, and although its capacity is limited, it follows that factors which impact on working memory are likely also to impact on ability to process new information. Baddeley & Hitch (1974) proposed two subsidiary storage or 'slave' systems (see Figure 2.4) which separate that which is heard from that which is seen into the 'phonological loop' and the 'visuo-spatial sketch pad' respectively (Baddeley & Hitch, 1974).

The phonological loop comprises a temporary verbal-acoustic system able to retain words and sounds. The visuo-spatial sketch pad is concerned with the integration of spatial and visual information which can be temporarily stored and manipulated. The episodic buffer is a third slave system, assumed to have links between the visuo-spatial sketchpad, phonological loop and long-term memory in which it can store multi-modal information, and the central executive has a role in the maintenance of attention (Baddeley, 2000). Research into the subsystems has concentrated predominately on the phonological loop (Pearson, 2001), it has been suggested that this may be due in part to the fact that it is easier to test theories and manipulate experimental material for verbal exploration than for visual stimuli (Baddeley, 2007). This observation is significant to this thesis because it is possible that a similar rationale may be related to a lacuna in the field of visual aid research.

Optimisation of working memory in lectures

The principles of WMT are central to this thesis for two reasons; firstly, the theory suggests the inclusion of a visual element in a lecture may increase the amount of information a student is able to process at one time. Secondly, WMT can be interpreted to suggest that the provision of simultaneous speech and text may cause interference in both verbal and non-verbal sub-systems. This is because if, as Baddeley (2003a) suggests, the phonological loop is required in a secondary stage to process text during reading, such a requirement may interfere with the processing of concurrent spoken language. Similarly, if the visuo-spatial sketch pad is initially required to perceive letter and word shapes, such an action might interfere with the production of mental models. Thus, if a lecturer wishes to provide an explanation which requires imagery on the part of the student, concurrent presentation of visual text may interfere with the process.

The roles of the separate slave systems in WMT suggest the provision of a non-textual visual display may facilitate dual processing, and thus increase capacity to process new information. In dual task experiments in which subjects were required to perform two simultaneous activities, Baddeley (2003a) observed the ability to perform a simple task which required involvement of one slave system was little different to that required to perform two simultaneous tasks, if the secondary task required the opposing slave system. Whereas, when subjects were presented with two simultaneous tasks which each required the same slave system, they were found to interfere with each other, and resulted in only one task recorded as performed correctly. This suggests if a verbal proposition can be elaborated upon by the provision of a purposeful visual representation which is non-textual, then even if the phonological loop is functioning at optimal capacity, working memory should be able to process the extra information in the visual modality, and thus effectively increase working memory capacity (Mayer, 2009; Mousavi, Low, & Sweller, 1995; Schnotz & Kurschner, 2007; van Merriënboer & Sweller, 2010). The notion that students' working memory may be increased by the provision of pedagogically purposeful visual aids in a lecture is central to this thesis. However, the role of text-based visual aids in this context is less clear.

The above suggestions are supported by the findings of Mousavi, Low, & Sweller (1995), who found the simultaneous presentation of two different but complementary modalities in the teaching of geometry enhanced learning; the researchers named this finding the 'modality effect' (Mousavi et al., 1995). However, a question remains regarding the validity of text presented as a visual aid, because if, as Baddeley (2003a) suggests, unfamiliar text is subvocalised upon reading, then the simultaneous presentation of speech and text may have the effect of overloading the phonological loop. According to Baddeley's (2003a) model, verbal information is processed in the phonological loop at some point whether it has been presented as the spoken word or as text. Conversely, if text is interpreted initially as an image, this might overload the visuo-spatial sketchpad. In each case, it is possible that the respective slave system may be overloaded by the presentation of redundant textual material, although the amount of text required to create such an overload is unclear.

The WMT model of a separate visuo-spatial sketchpad and phonological loop has been supported by fMRI and positron emission tomography (PET) investigations

(Awh et al., 1996; Belger et al., 1998). Richardson (1999) notes that although working memory is often assumed to be a gateway; for information to be processed in the visuo-spatial sketchpad and phonological loop, it must first be interpreted as meaningful from that which is already held in long-term memory. Baddeley (2003b) posits the episodic buffer (see Figure 2.4) assumes this role by providing an interface between the subsystems of working memory and long-term memory; as the artist David Hockney observes, ‘*We see with memory*’ (Gayford, 2011, p. 102). The pulling of schemas and objects from long-term memory into visual working memory for manipulation as a form of visual accompaniment may be instigated by a teacher or lecturer. The active use of imagery in support of teaching may be considered a form of visual assistance to learning, in that the student ‘sees’ something in their mind’s eye in accompaniment to the spoken content. Such a widened concept of a visual aid is discussed later in this chapter.

If the purpose of a visual aid is to support learning, its provision should increase the amount of information a learner is able to process at a given moment, however, it is possible that relevant images are not all equally helpful in this regard, and this is discussed in Section 2.4 below.

Dual Coding Theory

Dual Coding Theory (DCT) (Paivio, 1979) posits the existence of two cognitive ‘subsystems’ which recognise, differentiate and store visual information. One subsystem is specialised for dealing with language and the other for nonverbal perceptions. In the event of an input being coded by both subsystems, it is said to be ‘dual coded’ (Paivio, 1979) (Figure 2.5). DCT states information acquired this way is stored more

effectively, and is also made more accessible through being coded in both modes. Paivio (2007) suggests DCT can apply to complete sentences, however, the theory does not propose language presented as both speech and text is dual coded,

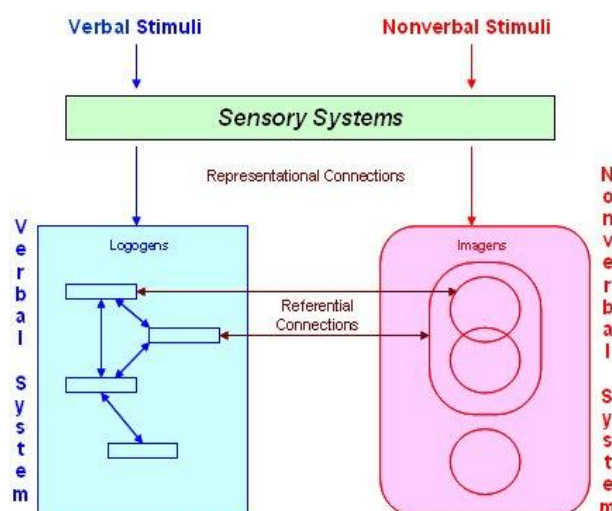


Figure 2.5 Dual coding theory (Paivio, 1979). Blue represents language; red represents images, smells and touch.

because the model suggests both are coded in the verbal system. An exception would presumably be hieroglyphic writing which contains elements processed in both channels. An example of text processed in both channels is shown in Figure 2.6, in which an image is combined within the text, so the capital 'I' of PISA also depicts the famous tower. Opportunities to combine text and images in this manner are likely to



Figure 2.6. Use of a pictorial element in a symbol system (Schnotz, 2001)

be limited in post-compulsory education, although as reported in Chapter 10, such a technique may be possible if an imaginative approach is employed.

DCT has been interpreted as 'conjoint processing' (Kirby, 1993), and also the 'conjoint retention hypothesis' (Kulhavy, Lee, & Caterino, 1985), in which learning enhancement was found when learners were presented with specifically prepared visual support. In a review of the literature which related to verbal and spatial processing, Kirby (1993) found that images were not advantageous in as many cases as experimenters had anticipated, and suggested that,

'more effort should be devoted to instruction, to teach students how to perform conjoint processing optimally' (Kirby, 1993, p. 213).

It is interesting to note that Kirby (1993) referred only to the ability of students, and did not comment on the competence of those who create the learning material to facilitate conjoint processing, as it might be argued that such an ability is also required on the part of a lecturer. Kulhavy et al. (1985) found maps which were semantically related to text improved retrieval of textual information, and they postulate this was because upon retrieval, visual information became available in working memory simultaneously with language. Larkin & Simon (1987) support the advantages of dual coding; they suggest images provide a perceptual enhancement, and in doing so improve storage in long-term memory. The conjoint processing and conjoint retention hypotheses have been largely eclipsed by the development of a Cognitive Theory of Multimedia Learning (CTML) (Mayer, 2005a) which is discussed below.

DCT does not feature heavily in contemporary literature; for example the theory has not been included in *Cognitive Psychology: A Students' Handbook* (Eysenck &

Keane, 2000, 2005, 2010) since the 2000 edition. Nonetheless, the theory has helped form the basis to CTML (Mayer, 2005a).

As can be seen from Figures 2.4 and 2.5, WMT and DCT offer alternative explanations for the processing of written text; WMT suggests that written text is, initially at least, processed in the visuo-spatial sketchpad, while DCT posits that verbal language, both written and spoken, is processed via the verbal channel. Both models support the notion that the provision of visual aids may increase available mental processing capacity, although WMT may be interpreted as suggesting that perception of text concurrent with speech may compete for capacity within the visuo-spatial sketchpad. Two contemporary processing models, the Cognitive Theory of Multimedia Learning (Mayer, 2005a) and the Integrated Model of Text and Picture Comprehension (Schnotz, 2005) attempt to be more explicit with regard to the processing of different language modalities, and are discussed below.

Cognitive Theory of Multimedia Learning

The cognitive theory of multimedia learning (CTML) (Mayer, 2005a) has links to DCT and is based on a dual channel assumption; one channel is available for

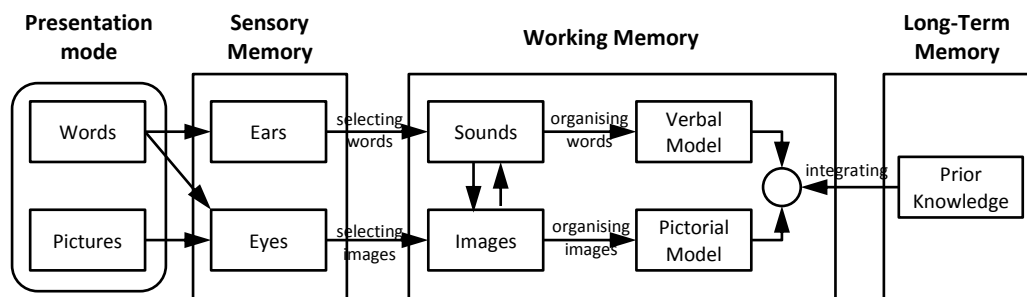


Figure 2.7. Cognitive theory of multimedia learning (CTML) (Mayer, 2005).

visual/pictorial processing, and a second facilitates auditory/verbal processing. This model is shown in Figure 2.7 and supports the simultaneous presentation of speech and images, as it suggests they are processed concurrently in auditory-verbal and visual-pictorial channels. These channels proceed toward the production of verbal and pictorial models which are integrated with prior knowledge from long-term memory. It is not clear whether text (which in this model is converted into text sounds) and speech are able to be processed concurrently, or whether an attempt to perform both actions simultaneously may overload the auditory/verbal channel. Another interpretation is that utilisation of both channels to process language may

result in cross-channel interference. This is discussed in more detail in section 2.5 below.

Integrated Model of Text and Picture Comprehension

The integrated model of text and picture comprehension (ITPC) (Schnotz, 2005) builds on DCT and encompasses reading comprehension, listening comprehension,

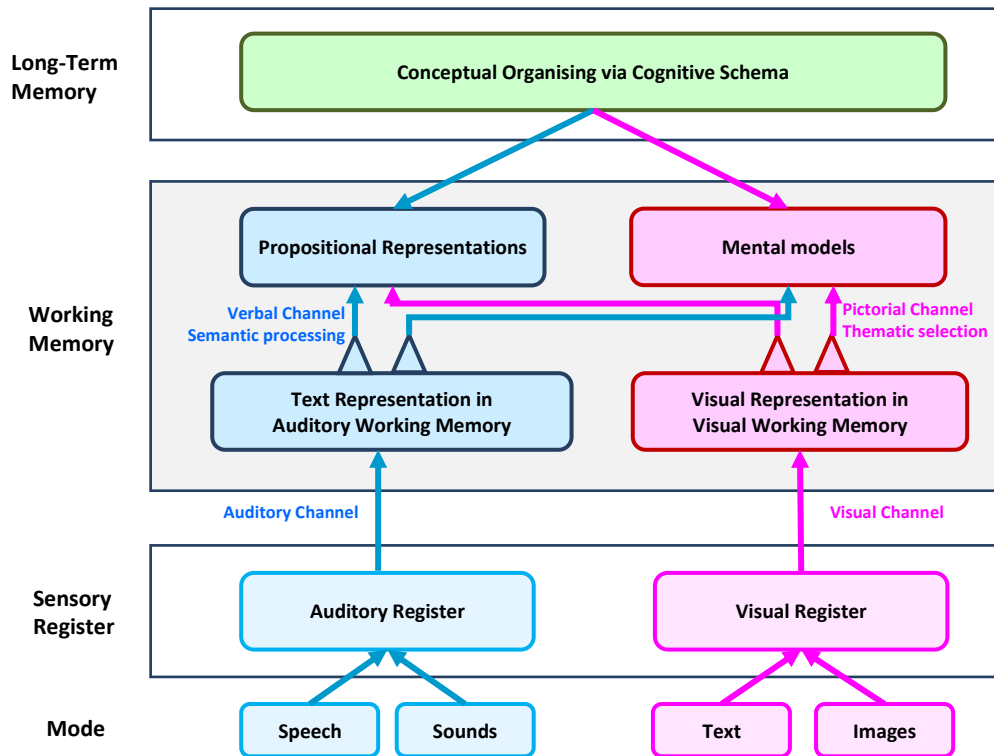


Figure 2.8. Integrated model of text and picture comprehension (ITPC) (Schnotz, 2005).

visual picture comprehension, and sound comprehension (i.e. auditory pictures) and is shown in Figure 2.8. As with CTML, the model proposes two channels at a cognitive level and supports the simultaneous processing of images and language.

Schnotz (2005) proposes that within working memory, filters (represented by triangles in Figure 2.8) select verbal information from visual working memory and channel them into propositional working memory. As with CTML, the model proposes that speech is processed in a verbal channel which has limited capacity to process and store information, while text is filtered in visual working memory and forwarded through the verbal channel to propositional working memory.

The theories outlined above have been predominately borne out of experiments which utilise material from the physical sciences and mathematics. Relatively little is

known about how these models might be applied to the communication of topics which have a less clearly defined visual entity, such as social sciences and philosophy. Additionally, as noted by Brunken et al. (2010), most of such studies have tested retention over quite short time spans, and their application over longer periods such as that of an undergraduate programme is less well reported.

Cognitive styles and learning styles

It is not within the remit of this thesis to critically appraise cognitive styles and learning styles theories per se, however they have the potential to inform visual aid design and use, and in this section I consider styles models which explicitly include a visual element.

Cognitive styles may be defined as *'individual differences in processing that are integrally linked to a person's cognitive system'*, and learning styles as *'an individual's preferred way of responding (cognitively and behaviourally) to learning tasks'* (Evans & Cools, 2011, p. 249). Schnotz and Kurschner (2007) note that without knowledge of human cognitive architecture, the effectiveness of instructional design is likely to be random, and one of the purposes of cognitive style theories is to attempt to reduce such uncertainty and inform the selection of teaching methods. However, for a teacher or lecturer who looks to the styles literature for guidance, the choice may be somewhat bewildering, as there are many models from which to choose.

The cognitive styles and learning styles literature represents a significant body of research; Evans & Waring (2012) note that over 30 cognitive style models and in excess of 100 learning style models are in circulation. Additionally, learning styles and cognitive styles have been criticised in analyses carried out by Coffield, Moseley, Hall, & Ecclestone (2004), and others (see for example, Pashler, McDaniel, Rohrer, & Bjork, 2009; Willingham, 2005). The debate may leave an enquiring teacher with uncertainty regarding the application of cognitive and learning style models to visual aid creation. Zhang, Sternberg, & Fan (2013) note that a perplexity brought about by a contrast between those advocating a match of styles in teaching, and by those who criticise a lack of evidence supporting the principle of teaching to styles, may lead many teachers to believe there is no point in applying the concept of styles to their practice (Zhang et al., 2013). Peterson, Rayner, & Armstrong (2009)

note that, '*confusion and contradiction with style definitions is a frequent criticism of the field*' (Peterson et al., 2009, p. 519). Evans & Waring (2012) note the extent to which styles have influenced instruction is '*often contradictory and ultimately confusing*' (Evans & Waring, 2012, p. 295). A consequence of such uncertainties may be that popularist models which are not based on peer-reviewed research appear to offer a simple solution resolution to the problem, and one such model is discussed below.

Evans & Cools (2009) note that not all styles models include due methodological rigour and practical relevance; they cite Visual-Auditory-Kinaesthetic (VAK) theory as one such model, and describe it as an example of popularist science with little theoretical underpinning. Sharp, Bowker, & Byrne (2008) suggest that although VAK is frequently encountered in education and training, it is essentially outside the arena of serious debate. Nonetheless, VAK seems to be insidious in the education world; Evans & Waring (2008) found many trainee teachers tend to link their ideas about differentiation to VAK with little reference to more established theories. Sharp et al. (2008) found such an acceptance of VAK among trainee primary teachers, and linked this finding to a programme of Accelerated Learning in Primary Schools (ALPS). The originator of the ALPS programme, Alistair Smith, credits VAK to the principles of Neuro-Linguistic Programming (NLP) (Smith, 1996, 1998). In his book '*Accelerated Learning in Practice*', Smith (1998) offers broad statements such as, '*29% of people prefer to learn by seeing*' (Smith, 1998:147). VAK has origins in NLP, which emanates from the ideas of Bandler & Grindler (1979), however the theory has been widely criticised for not having a credible research basis (see for example, Roderique-Davies, 2009).

Other styles researchers refer to 'visual learners'. Dunn & Dunn (1993) were key researchers in the learning styles field (Evans & Cools, 2011), and the Learning Styles Inventory (LSI) (Dunn & Dunn, 1993) was noted as one of five dominant models used in school settings by Evans & Waring (2012). For a teacher wishing to create visual aids which assist their students, statements such as; '*visual learners remember 75% of what they read or see*' and '*approximately 40% of the population is visual*' (Dunn & Dunn, 1993, p. 402) might be interpreted as justification for the display of comprehensive text summaries or of relevant images, and such broad-

brush statements may attract those who seek a succinct appraisal of the styles literature.

Statements such as,

‘Visual learners prefer to learn by seeing. They have good visual recall and prefer information to be presented visually, in the form of diagrams, graphs, maps, posters and displays.’ (Pritchard, 2009, p. 45)

are characteristic of advice offered for the preparation of learning for ‘visual’ learners. Dunn & Dunn (1993) further divide visual learners into ‘global’ and ‘analytic’ learners, and explain that *‘analytic visuals make sense out of printed words...global visuals don’t pay much attention to written or printed words’* (Dunn & Dunn, 1993, p. 400).

An example of how a leap from peer-reviewed styles literature to the VAK model might be taken can be found in *Learning Styles and Inclusion* (Reid, 2005). Within three successive paragraphs the author takes the reader from the Cognitive Styles Analysis (CSA) (Riding, 1991), through Kolb’s (1976) learning cycle, to a conclusion that *‘the easiest strategies to implement in the classroom are the visual, auditory, kinaesthetic/tactile approaches’* (Reid, 2005, p. 121). Reid’s assertion that VAK is ‘the easiest’ to implement, may offer insight into the popularity of the model. However, one is reminded of the apocryphal story of a drunk looking for his lost keys under a street lamp because the light is better there, even though he lost his keys in an unlit section of the road; the adoption of VAK theory because it is ‘easiest’ is arguably no more rational.

Geake (2005) noted that although the research basis for VAK is questionable, the Department for Education and Schools (DfES) (as it then was) effectively sanctioned the model by including it on their website. Categorisation of learners as ‘visual’ has made its way into the visual aid research literature; for example, when Kunkel (2004) assessed the benefit of presentation software on two contrasting courses, he postulated that *‘having something to look at during a lecture’* would be helpful for learners with a *‘visual preference’* (Kunkel, 2004, p. 194).

The VAK model has also been developed into a variant known as *Visual, Auditory, Read/write, Kinaesthetic* (VARK) (Fleming & Mills, 1992). Fleming & Mills’ (1992) VARK model differs from VAK in that the category of ‘visual learner’ specifically (and

perhaps counter-intuitively) excludes PowerPoint. Their website states that the 'visual preference',

'does NOT include still pictures or photographs of reality, movies, videos or PowerPoint' (Fleming, 2011) [emphasis in original].

Fleming (2011) does not elaborate upon why 'PowerPoint' might not be appreciated by visual learners; it appears that he refers to text-based slides, since other forms of potential content such as pictures, video, diagrams and charts are excluded by name.

The co-existence of VAK and VARK theories creates uncertainty with regard to the preferences of 'visual learners' depending on which of these models is utilised. For example, the websites of the Universities of Leeds (2011), Birmingham (2011), Southampton (2003), and the Information and Digital Technologies (JISC) website (JISC, 2009), all suggest that 'visual learners' like pictures and find them helpful when learning. Conversely, the websites of Universities of Liverpool (2011), and Aston (2011) offer Fleming's (1992) VARK model, which specifically *excludes* the use of pictures and video from modalities likely to be helpful to visual learners; these are included in the 'kinaesthetic' domain for those who prefer simulations of 'real things' (Fleming, 2011). City & Guilds (2007) include VARK in their post-compulsory teacher training syllabus Diploma in Teaching in the Lifelong Learning Sector Qualification Handbook (City&Guilds., 2007), as does the University of Plymouth PGCE/Cert Ed module handbook for post-compulsory ITT (Exley, Hughes, Lambert-Heggs, & Webster, 2011). Thus, lecturers who wish to create visual aids for learners who display a preference for visual materials are presented with a dilemma with regard to whether they should show their students images, or text, or neither.

Riding's (1991) CSA is an established cognitive style model which offers insight to visual aid design and use. The CSA measures individual style along two orthogonal dimensions; wholist-analytic and verbal-imagery, and the verbaliser-visualiser continuum is particularly relevant to the design and use of visual aids for students. The verbaliser-visualiser scale was originally developed by Paivio (1971) and later revised by Richardson (1977). Riding & Douglas (1993) found visualisers responded better to images which were designed to support a text passage than verbalisers, although they did not clearly define the level of imageability of the text used. Riding, Grimley, Dahraei, & Banner (2003) suggest that although style may

indicate a preference, both verbalisers and visualisers can use either mode if they make a conscious decision to do so. However, the visualiser-verbaliser dimension of the CSA has been found to have low reliability (Evans, Richardson, & Waring, 2013; Evans & Waring, 2006), and Blazhenkova & Kozhevnikov (2009) note that research on the visual-verbal style declined over the first decade of the 21st century due to its reported lack of construct and predictive validity.

In comparisons of learners classified as either visualisers or verbalisers, Massa & Mayer (2006) found significant correlations between self-report measures of cognitive style and learning behaviour, and also between self-report measures of learning preference and learning behaviour. However, they did not find support for the addition of pictures for visualisers alone, (or for the converse of adding verbal aids to help verbalisers), and found the addition of pictorial aids helped both visualisers and verbalisers (Massa & Mayer, 2006). This finding is significant because it supports the suggestion that task-appropriate visual aids may also be of benefit to learners other than those who exhibit a preference for visual materials; carefully designed visual aids need not necessarily hold back verbalisers, and at times may help those with a verbal preference. It should also be borne in mind that the visual support in the above experiments comprised carefully designed explanatory pictures and diagrams, rather than relevant decorative images which were simply 'something to look at' (Kunkel, 2004).

The provision of images for this reason may not be entirely specious however; Thomas & McKay (2010) studied the comparative impact of text-only, text and pictures, and text and diagrams, when teaching personality theory to undergraduate students. The text and pictures variant included images which were relevant but with no purpose directly linked to learning outcomes. The researchers found a positive correlation between results and learners' preferred cognitive styles. This finding does not accord with the notion that images which are not educationally purposeful may create a negative impact (Harp & Mayer, 1998; Schnotz, 2005), and is an area in which further research may provide new insight.

Within the visual medium, variation in individual cognitive style has emerged as more complex than the single continuum from visualiser to verbaliser proposed by Richardson (1977). The notion that individuals possess either high-imagery or low-

imagery abilities does not account for differences in performance between spatial tasks such as the interpretation of graphs or rotation of mental images, and those which require the construction of detailed, concrete mental images (Kozhevnikov et al., 2002). Kozhevnikov et al. (2002) found evidence to support the existence of an object imagery system that processes the appearance of objects, and a separate spatial imagery system that processes spatial relationships within an object and in relation to its surroundings. Neuroscience research also supports the notion that spatial imagery and object imagery recruit different areas of the brain (Kosslyn, Ganis, & Thompson, 2001), and that visual and verbal systems are functionally and anatomically separate (Gazzaniga, Ivry, & Mangun, 2009). Thus verbal, object and spatial dimensions are considered to be relatively independent, and Blazhenkova & Kozhevnikov (2009) have developed an Object-Spatial Imagery and Verbal Questionnaire (OSIVQ) to assess these three cognitive styles.

Although the three dimensional model proposes relatively independent cognitive abilities, Kozhevnikov, Blazhenkova, & Becker (2010) found that spatial imagery tasks can exhibit a degree of interference with both object and verbal styles; while object imagery did not interfere with verbal style; a finding which supports the dual-coding model (Paivio, 1971).

Plass, Kalyuga, & Leutner (2010) note learners with low spatial imagery ability may experience high intrinsic cognitive load in situations which require visual navigation, and Kozhevnikov et al. (2002) suggest students might be taught strategies to enable them to translate material to representations that are compatible with their own preferred cognitive style, although Kozhevnikov, Kosslyn, & Shephard (2005) believe further research should be carried out in order to discover the degree to which learners can be trained to use their less-preferred type of imagery effectively. As Kozhevnikov et al. (2010) found that none of the participant groups in their study showed above average abilities in both spatial and object visualisation skills, the efficacy of attempting to develop an area of lower ability remains uncertain.

The relationship of cognitive styles and learning styles to text

The styles literature is not consistent with regard to the role of text as a visual aid. Felder (2002) notes that one medium of information transmission that is unclear in this context is written prose. Referring to his Index of Learning Styles (ILS), Felder

(2002) observes that as text is perceived visually, it cannot be categorised as auditory, but that it is also inaccurate to categorise text as if it were a picture. For this reason he includes text in the 'verbal' category of the ILS visual-verbal pairing.

In Multiple Intelligences (MI) theory, Gardner (1983) includes both speech and text in 'linguistic intelligence'. Although Gardner (1999) states that he does not consider MI to be either a cognitive style or a learning style, Chan (2012) notes advocates of VAK have found theoretical support in MI theory. Some writers suggest visual learners prefer language in the form of text, for example from writing and reading notes (Reid, 1987). This view is supported by Warwick University in their guidance on study techniques; they suggest visual learners like to *'learn by seeing, often through written language, such as reading and writing'* (Warwick, 2011). Yet as noted above, VARK (Fleming & Mills, 1992) places text in a separate read/write category and excludes this modality from the visual learner preference. Thus it remains unclear whether a lecturer who wishes to display text as a visual aid would meet the preferred learning style of a visual learner or an auditory learner, and the possibility exists that, rather like Reid's (2005) justification for the application and use of VAK theory, text may be offered as a visual aid simply because it's easiest.

Evans (2009) notes that a preference for one type of processing does not necessarily exclude a learner from processing in another style. Jonassen & Grabowski (2011, p. 37) describe a technique which entails *'compensatory matching'*, in which an instructional method is deliberately selected which does not match a learning preference; the teacher instead utilises a method that models the undeveloped ability in the learner. Evans & Waring (2008) suggest it *'may be possible to develop strategies to address any inherent bias toward one style or another'* (Evans & Waring, 2008, p. 151). Zhang et al. (2013) suggest students may welcome teaching styles that either challenge or complement their own preferred styles, and posits that the traditional conception of style match may be *'a myth'* (Zhang et al., 2013, p. 235). The above comments support the notion that a carefully designed visual aid which models best instructional practice (as opposed to a hastily created PowerPoint slide), may cater not only for learner preferences but also develop an appreciation for less preferred modalities. This is an area which requires further research, as Evans & Vermunt (2013) note some students welcome cognitive style mismatch while others do not.

The application of cognitive styles and learning styles theories to visual aid design remains complex and warrants further investigation in order to provide clarity for those who wish to apply these theories to their visual designs. Further research in the learning styles and cognitive styles arena will doubtless provide insight in the future; however the wide and sometimes conflicting variety of advice currently available in support of the visual medium does not provide reliable or consistent guidance for teachers and lecturers.

2.4 Images as an aid to learning

The models discussed above suggest the provision of carefully designed images in support of speech should aid understanding, and research into recall following the reading of prose has shown that people often learn better from text which is accompanied by images than from text alone (Levie & Lentz, 1982; Levin, 1981).

The 'Picture Superiority Effect' (Nelson, Reed, & Walling, 1976; Paivio & Csapo, 1973) suggests pictures should create an increased impact when compared with text. In experiments which tested recall after exposure to either single words or pictures, Paivio & Csapo (1973) found the presentation of a picture to be twice as effective when used in support of delayed recall as the presentation of a related noun. Conversely, for a word to be as visually effective as a picture, it required to be presented twice. Nelson et al. (1976) suggest this finding may be attributed to a qualitative superiority of sensory codes for pictures. Curran & Doyle (2011) have confirmed the effect using event-related brain potential (ERP) measurements in which they tested participants' memory for previously seen words and pictures.

The aphorism 'seeing is believing' suggests something perceived with one's own eyes is likely to be believed, even though that which is seen may not necessarily be correct or true. The presentation of an image which is not accurate, or a complete fabrication, may nonetheless engender verisimilitude on the part of a viewer. This has been recognised since the 19th century; a painting by Delaroche which depicted Oliver Cromwell holding the lid of the coffin of Charles 1st whilst looking down at the corpse, fomented a popular belief that such an event took place, despite there being no record of any such occurrence (Crary, 2008). The faking or judicious altering of images has been shown alter perceived memories in experiments with adult subjects (see for example, Garry & Wade, 2005; Henkel, 2011; Newman, Garry, Bernstein,

Kantner, & Lindsay, 2012; Wade, Garry, Read, & Lindsay, 2002). Brown & Marsh (2008) and Henkel (2011) found false beliefs related to past events could be created by the falsification of photographs, which after a few weeks were observed to have morphed into a remembered event in the memories of some participants. The addition of an image to text has been shown to add verisimilitude or 'truthiness' in a way that is not currently clear, and Newman et al. (2012) found the addition of a photograph to a PowerPoint slide could influence the credibility of a statement contained therein. They added a photograph of a person unknown to the participants to a slide which contained the phrase, 'This person is dead' or 'This person is alive'. For both phrases, more subjects judged the statement to be true with an accompanying photograph than with a name only.

Sherwin (2008) notes that words constructed by a speaker are understood to be at one remove from the reality they describe, whereas photographs are a representation of the external world and may thus seem to present better evidence for that which the speaker wishes to depict. McCabe & Castel (2008) found undergraduate subjects rated fictitious cognitive neuroscience articles more highly if the text was accompanied by images of fMRI scans, than if the articles contained bar charts, topographical images, or no image at all. Although the images used by Newman et al. (2012) and McCabe & Castel (2008) were not task-appropriate, they nonetheless created an impact on the viewers. This finding is relevant to this thesis because although one would presume teachers and lecturers do not seek to engage in deliberate deception, the authentic appropriation of images may increase engagement and acceptance of a concept.

The notion that further research into the use of images as visual aids may hold promise for adult education is supported by the findings of Prabu (1998) and Prabu & Jagdeep (1998). In the context of education for trainee journalists, they compared visual-verbal associations between pictures and news stories. Prabu & Jagdeep (1998) found, as DCT predicts, the addition of high imagery speech to a story resulted in a significant increase in retention, and a similar increase was recorded following the addition of an image with strong visual impact. However, of particular relevance to this thesis is Prabu & Jagdeep's (1998) finding that the addition of high imagery speech and an image did not produce a cumulative improvement in recall; the researchers postulate this may indicate their participants' recall ability had

reached a ceiling. This finding may also be accounted for by a loss of purpose on the part of the image once descriptive writing had been added, because the narrative was already optimally dual coded. Such a limit to the enhancement of language was observed in the 19th century with regard to the later novels of Charles Dickens, in which the author was judged by many to have developed his descriptive writing to the point that illustrators could no longer add to the narrative; their drawings seemed only to iterate his words (Cohen, 1980). Prabu & Jagdeep (1998) suggest,

'Given the high correlation between imagery and concreteness, academics and educators can help by stressing the importance of imagery evoking, concrete language' (Prabu & Jagdeep, 1998, p. 28).

Their observation suggests that if a lecturer employs descriptive speech, or actively stimulates imagery among students, there may be no benefit to be derived from the additional display of an image-based visual aid.

Although the addition of images to stories has been shown to improve recall, Prabu (1998) found the addition of images to abstract text narratives created no improvement. He suggests this finding may be attributed to a lack of available images with which to illustrate abstract events, and posits that the participants in their study were *'not working hard enough to obtain suitable images'* (Prabu, 1998, p. 198). This result may also be attributable to participants not knowing where to find images which might support abstract stories or how to create such depictions, and this notion is particularly relevant to this thesis because much post compulsory education involves the teaching of abstract concepts.

The inclusion of people in an image is known to have a significant impact on the direction of attention, even if they are not known or recognisable to the viewer. Buswell (1935) conducted some of the first eye tracking experiments and noted that in pictures containing people, the figures received a disproportionately large number of eye fixations compared with other items. This finding was borne out by Yarbus (1967) who undertook experiments in which subjects viewed a painting which contained several figures. He found their eye movements tended to concentrate on people, but which figures drew attention depended on the nature of questions asked of the observer.

If a picture includes a face known to the viewer, the impact on attention is significantly greater than that of an unknown face (Knobloch, Hastall, Zillman, & Callison, 2003). Knobloch et al. (2003) investigated the attention of subjects who viewed Internet news articles, and recorded a powerful impact for pictures containing a face known to the viewer. Their finding is supported by the proposal that we may have neurons dedicated to the memory of individual faces which are of importance to us, as evidenced by a suggestion that (depending on one's taste in movies), there may be a neuron dedicated to recall of Jennifer Aniston's face (Gosline, 2005). Knobloch et al. (2003) also recorded increased attention brought about by the display of emotive images. This area warrants further research, as teachers and lecturers may be able to add an affective element to their visual aids by the display of images which contain faces known to their students.

Images may not automatically support learning

Dewey (1913, p. 12) cautioned against making a subject falsely interesting by surrounding it with '*artificial stimuli and... fictitious inducements to attention*', and a contemporary term for such inducements is 'seductive details' (Harp & Mayer, 1998). Harp & Mayer (1998, p. 414) define such non-essential elements as, '*information that is only tangentially related to the topic*'. For teachers and lecturers who elect to display images, a lack of readily available subject-specific graphics may result a visual display which is only 'tangentially related to the topic', for example images from Internet 'iStock' photo sources or Microsoft Clipart cartoons. Provision of an image which is merely relevant may not automatically produce a positive impact on learning. The visual display should be 'task-appropriate' because a picture superiority effect (Nelson et al., 1976) cannot be extrapolated to all images regardless of relevance or context (Schnotz & Bannert, 2003). Investigations which examine the efficacy of images in a lecture environment appear less frequently in the literature than those which investigate their use in textbooks; but the latter nonetheless offer insight into the efficacy of images used in education. For example Mayer (1993) investigated US sixth grade science text books and found only 15% of their illustrations supported learning; the remainder were found to have a function which was primarily decorative.

Mayer & Gallini (1990) investigated the efficacy of illustrations designed to support explanations of the workings of a car braking system, and found relevant but

purposeless images did not aid learning when compared with illustrations designed to be explanative. It is difficult to quantify the degree to which the presentation of innocuous (as opposed to irrelevant) illustrations in a lecture might actually impair mental processing by taking up visual working memory as suggested by Schnotz & Bannert (2003). Explanative images have been found to have a negative impact on learners capable of creating their own visualisations; Mayer & Gallini (1990) found explanative images helped learners with low prior knowledge, but not those with relatively high knowledge. Schnotz & Bannert (2003) suggest the display of a task-inappropriate image may interfere with creation of mental models, although they note that well-designed images are also important for learners with high prior knowledge. The impact of task-inappropriate images which hinder mental model construction for high-knowledge learners is known as the 'expertise reversal effect' (Kalyuga, Ayres, Chandler, & Sweller, 2003). In this context a 'high-knowledge learner' is not necessarily a subject expert, but one who is sufficiently familiar with a concept to be able to draw images and models from long-term memory. This suggests an image displayed as a visual aid merely because it is relevant will not automatically result in improved processing, and may impair a student's ability to create their own mental representations.

The degree of interference which is brought about by the presentation of visual stimulation which has no outcome-related purpose is not completely clear. Many studies have been undertaken which have shown that digital visual noise (DVN) which comprises a grid of black and white dots that randomly change colour, can interfere with working memory tasks (see for example, Baddeley & Andrade, 2000; Darling, Della Sala, & Logie, 2007; Dean, Dewhurst, & Whittaker, 2008). Studies in which varying levels of visual distraction have been presented to subjects suggest the degree of congruence of the distraction with the task may proportionately influence the level of interference (Clapp, Rubens, & Gazzaley, 2010). For example, Borst, Ganis, Thompson, & Kosslyn (2012) asked subjects to recall images of letters from alphabets with which they were unfamiliar such as Hebrew and Cyrillic, and a recall task followed interference in the form of either unstructured DVN, or a structured form of visual noise which included elements contained within the memory task. They found subjects' visual working memory was interfered with more strongly by structured visual patterns than by non-structured.

Working memory interference may also be caused by a distractor which contains interest or meaning. For example, Wais et al. (2010) measured the effect of interference on working memory by visual distractors which were irrelevant but which comprised relatively complex images of outdoor scenes. Wais et al. (2010) found such depictive images interfered with recall from long-term memory, presumably because although irrelevant to the task, they held some interest for the viewer. Experiments such as these suggest that visual stimuli are processed in working memory even if they are not relevant or necessary for the task. An interesting (if somewhat immoral) use of interference on working memory has been recorded in American courtrooms; in which sequences of projected images which are relevant but essentially task-inappropriate, and which communicate one meaning after another, have been used by lawyers in an attempt to disable critical thinking among jury members (Sherwin, 2008).

Schnotz & Bannert (2003) suggest that images used in teaching and learning should be considered and planned carefully, with thought given to whether an image supports the mental model desired by the lecturer. Their approach is significant because it is contrary to advice commonly provided regarding the use of images, in which selection of relevant images from Internet-based commercial collections is often advised (Atkinson, 2005a). The display of images which do not possess a clearly defined pedagogical function in a lecture is investigated in the Modalities exploratory study reported in Chapter 7.

Images need not necessarily be presented in the form of accurate depictions in order to assist learning; Levie (1987) noted cartoon caricatures may be perceived more rapidly than a true depiction because they highlight salient features (see also, Chabris & Kosslyn, 2005). In the 1960s and 1970s, commercial organisations made widespread use of flipcharts during presentations, and Griffin (1994) recalls that the firm DuPont always had an artist available to provide visual support during presentations to management. Such expertise is analogous to the technical support available to contemporary universities, although such technicians usually limit their involvement to operation of software and hardware (Green, 2006). The ability to create depictions on a blackboard requisite for Victorian teachers (Robinson, 2004) is no longer a formal requirement; and although such training is available in the 21st century in the form of cartoon and drawing workshops for trainers and presenters

(see for example, Shaw, 2011), the literature does not record teachers' and lecturers' proficiency in such skills.

Levie (1987) found the presence of pictures in a book facilitated analogical reasoning due to making information more concrete and imaginable. Weidenmann (1989) noted that although viewers can often take in superficial information from a photograph more quickly than reading text, such a process can lead to an illusion of full understanding, and Schnotz (2001) cautions that without guidance, learners often underestimate the informational content of pictures. Weidenmann (1989) showed subjects pictures which depicted contrasting leadership styles, and observed that when no instructions were given as to how to interpret the images, their beneficial effect was reduced. Tabachneck-Schijf & Simon (1996) caution that visual displays which are unfamiliar to an observer may mislead them into picking up features as cues irrespective of their relevance. Thus the role of a teacher or lecturer may involve providing a cue to a displayed illustration or model. In a study undertaken in medical training, the active direction of students' attention to salient visual content has been shown to enhance the learning of trainee surgeons (Wilson et al., 2012). The researchers suggest this may finding may be due to visual cueing reducing the demand on working memory which might otherwise be taken up searching unhelpful sections of scenes.

2.5 Textual iteration of the spoken word

Many teachers and lecturers display textual summaries of their words while they speak. However, if one removes the requirement to take notes for future revision, the educational function of text which is displayed concurrently with speech becomes less clear. Felder & Henriques (1995) observe that when textual material is unfamiliar or difficult, lexical memory is speech-accessed, and thus is more likely to be speech-mediated than silently read, which accords with the proposition of Baddeley (2003a) that text may be subvocalized on reading. By definition, teaching and lecturing is concerned with topics of varying degrees of unfamiliarity and difficulty for students, and this raises a question regarding the processing of that which is presented in the form of text-based visual aids. If students do silently articulate new or difficult textual information, it is possible that the effect of a text-based visual aid is to allow the students to 'hear' the words twice. This notion is examined below.

The Redundancy Effect

The phrase 'redundancy effect' describes a negative impact on learning arising from the simultaneous presentation of information in two modes, or conversely, an improved impact following the removal of one mode (Chandler & Sweller, 1991).

Kalyuga, Chandler, & Sweller (1998) suggest the presentation of text and simultaneous narration may create a negative effect on learning compared with the use of one modality alone. Intuitively, it might seem that iteration of language in an alternative mode should assist learning, and Severin (1967) notes that in the first half of the twentieth century there was general agreement amongst teachers that more information is acquired when presented through more than one channel at a time. Severin (1967) criticises the joint presentation of text and speech,

'communications which combine words in two channels (words aurally and visually in print) will not result in significantly greater gain than single-channel communications since the added channel does not provide additional cues' (Severin, 1967, p. 243)

Mondfrans & Travers (1964) suggest the practice of repeating speech by means of a textual display is motivated by a belief that,

'bombarding [the learner] with redundant stimuli ensures a greater amount of learning since [he/she] receives more instances of the same material, each of which might be conceived as a separate learning trial.' (Mondfrans & Travers, 1964, p. 743)

The description 'bombarding with redundant stimuli' might be applied to some contemporary lectures supported by text-heavy visual aids which earn the accolade of 'Death by PowerPoint' (Garber, 2001) or 'Drone warfare' (Gibbs, 2013), and although 'bombarding' is not usually to be found in the educational lexicon, the integrity of the practice of providing simultaneous speech and text in post-compulsory education seems to go largely unquestioned. This underpins one of my research questions, namely; what effect does the simultaneous provision of speech and text have in post-compulsory class and lecture room environments?

Severin (1967) and Mondfrans & Travers (1964) reviewed the literature of the period, and found the data did not support the practice of language presented in two simultaneous channels. Since then, others have recorded similar redundancy effects when text and speech are presented together (see for example, Craig,

Gholson, & Driscoll, 2002; Diao & Sweller, 2007; Kalyuga, Chandler, & Sweller, 2004). Mayer (2001) suggests when verbal information is presented both visually and auditorily, learners may be tempted to attend to both *'in an attempt to reconcile the two information streams'* (Mayer, 2001, p. 153), and Sadoski & Paivio (2004, p. 1335) suggest in this instance, listeners must *'shuttle'* between the two. Kalyuga et al. (2004) relate the combination of text and speech to CLT, they suggest that redundant information *'consumes cognitive resources that become unavailable for learners to process essential information'* (Kalyuga et al., 2004, p. 568). It should be noted that in this context the redundancy effect refers to text and speech which Severin (1967) suggests is the only situation in which complete redundancy can occur, he adds,

'Multichannel communications which combine words with related or relevant illustrations will provide the greatest gain because of the summation of cues between the channels' (Severin, 1967, p. 243)

Severin (1967) does not enlarge upon the degree of relevance or acuity of design that such illustrations should possess.

Prior to the development of computer-based learning, the lecture theatre or classroom was the only environment in which students were presented with concurrent speech and text. Ordinarily one would not read a book whilst listening to the same text delivered from a recording; once children have learnt to read unaided, the person who taught them gradually withdraws from the role, and does not persist in reading aloud. Although writing has been in existence in civilised societies for many hundreds of years, there is little evidence of concurrent presentation of auditory and visual language, and it is not clear if, or how an ability to process language from two simultaneous sources might have evolved; Leahy & Sweller (2011) suggest it is likely humans evolved to listen to speech whilst visually observing.

The redundancy effect has the potential to impact upon many forms of teaching because of its ability to consume working memory capacity that might otherwise be available. Yet Sweller (2005) records that despite being known about for many decades, the redundancy effect has been *'forgotten and rediscovered many times'* (Sweller, 2005, p. 159). Sweller (2005) suggests a reason for the limited impact of the redundancy effect on learning design may be that for many researchers and

practitioners it is counterintuitive. Another possible reason is that if a redundancy effect is present during a lecture, it is unlikely to be experienced (or at least not directly so) by the lecturer. Furthermore, even though students may be conscious of competing demands on their attention, it may not be evident that such an iteration can create a negative impact on their learning.

Long sections of complex speech may be difficult for a listener to hold in auditory form, an observation named the 'transitory information effect' (Leahy & Sweller, 2011). Leahy & Sweller (2011) suggest it may be helpful in such instances to provide text so that important aspects can be re-accessed by learners, and this observation supports the use of visually projected text summaries as commonly seen in lecture theatres. However it is important to note that the context for their suggestion is that of learners who follow instructions for a task in which there is no further auditory information provided which might interfere with reading; in a lecture such a secondary provision may create a redundancy effect due to an absence of pauses in which to read and consider the text.

Some studies have found the simultaneous presentation of text and narration to be effective; for example, Penney (1989) and Lewandowsky & Kobus (1993) found words presented in both modalities produced enhanced memory recall. However, these studies employed single words and digits, whereas in a lecture the presentation of longer sections of speech and associated text are inevitably asynchronous due to differences in reading and speaking speeds (Schnitz, 2005). Rummel, Schwelpe, Furstenberg, Seufert, & Brunken (2010) found that if the quantity of text to be read requires eye movement, it may interfere with the rehearsal component of visuo-spatial working memory. In a lecture environment, redundant text may be effective when shown as short sections, such as in the so-called 'Lessig' minimalist style popularised by the American academic Lawrence Lessig (Reynolds, 2005a), in which speech is supported by the timed display of single words and short phrases which can be read with minimal saccadic movement. However, I have been unable to locate any research which has inquired into the efficacy of this technique, and the Lessig method forms part of the Main modalities study reported in Chapter 9.

It should be noted that the redundancy effect refers only to a negative impact on learning brought about by the presentation of secondary material concurrently with

the primary source, and does not necessarily apply to the provision of such material asynchronously. Repetition is known to have a positive impact on retention (Ausubel & Youssef, 1965), and may also influence a learner's likelihood to agree with a concept (Moons, Mackie, & Garcia-Marques, 2009). It is possible that this principle has transmuted into a belief among some teachers and lecturers that concurrent iteration has a similar effect to that of asynchronous repetition.

It is known that images can be topographically organised within the brain, and Tootell, Silverman, Switkes, & De Valois (1982) provided a graphic demonstration with the aid of a section of primary visual cortex removed from a monkey which had been exposed to an image of a web-like pattern. A recognisably similar pattern was observed on the section of tissue (see Figure 2.9). Kosslyn (2005) suggests this capacity may be equated to a 'visual buffer', which is able to hold visual images from signals received by the retinas.

The amount of text which can be retained visually appears to be relatively small. Lewandowsky & Kobus (1993) found the recall of single words to be enhanced by concurrent presentation of speech and text, and Penney (1989) suggested that additional processing capacity is made available when two such modes are used. Logie, Della Salla, Wynn, & Baddeley (2000) compared recall of sequences of short words which were visually similar, such as FLY, PLY, CRY, with sequences that were phonologically similar but visually dissimilar, such as GUY, THAI, SIGH. They found participants performed more poorly when items were visually similar, and this supports the notion that visual working memory may be involved in such retention. If so, this suggests a visual aid which comprises a small number of letters or shapes, as in a 'Takahashi' style of presentation in which single Japanese characters are displayed (Reynolds, 2005b), may have a lasting visual impact which is not formed by the more complex display of a complete sentence.

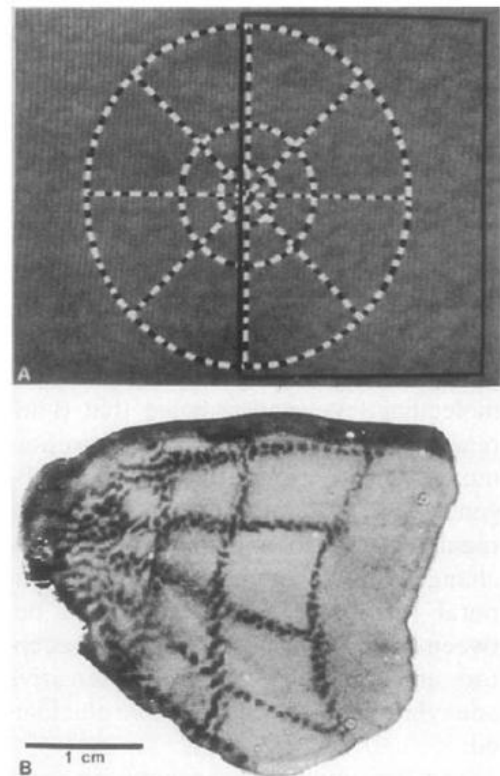


Fig 2.9 Section of monkey striate cortex indicating topographical representation of object perceived (Tootell et al., 1982).

It is possible, concomitant with the findings of Tootell et al. (1982), that if one were able to take a section of striate cortex from a member of the audience at a Takahashi presentation, one might observe a residual image recognisable as a Japanese character. However, it is unclear whether such a section taken from the brain of a student who had viewed a text image which comprised 40-60 words, would show a similar number of outlines identifiable as the Roman alphabet. This invites a question with regard to the optimum amount of text which might be displayed but which does not interfere with the processing of spoken language. The efficacy of displaying short sections of text is investigated in further in Chapter 9 of this thesis

The ability to read longer sections of text whilst listening to spoken language is not unknown; Shaffer (1975) found a skilled typist was able to type a visually presented message and simultaneously attend to an unrelated verbal input. However professional typists are likely to have developed the ability to reproduce text without a need to fully comprehend the meaning. Students are not skilled typists (at least not in the sense the term was used in the 1970s) and their role in a lecture audience is not analogous to that task because they must comprehend both that which is read, and that which is spoken. Many of us have experienced a colleague talking whilst we typed, and found that once we attended to that person, we began to include their words in our manuscript. Penney (1989) observed this phenomenon and noted,

'It seems that visually presented verbal stimuli are recoded through silent articulation... and this code is susceptible to interference from auditorily presented distraction' (Penney, 1989, p. 402).

It is possible that a similar interference might occur in a lecture theatre if students attempt to read detailed text at the same time as they listen to the lecturer, and that such interference may create a redundancy effect (Sweller, 2005). De Beni & Moe (2003) note that reading and imagery both involve components of the visuo-spatial sketchpad, and may cause interference. Lecturers who offer text-based slides concurrently with descriptive speech may thus diminish the ability of students to imagine that which is proposed.

Adesope & Nesbit (2012) carried out a meta-analysis of published studies in which they compared the effectiveness of spoken-only, written-only, and spoken-written presentations, and examined the results from 33 research papers (totalling 57

studies). It should be noted that any visual impact brought about by the presence of a lecturer was absent from this meta-analysis as the reading in all studies was undertaken either from paper or a computer screen. Adesope & Nesbit (2012) included a small number of studies which compared narrative-text with text-only presentation, and found subjects did not learn more from spoken-written presentations than those which were written-only. This finding is significant because it supports the notion emergent in this literature review that the practice of providing a comprehensive text summary concurrently with speech may be limited in its functionality.

There are few studies in the literature which use a live lecture situation to examine the effect of bimodal presentation of text and speech; most employ computer based individual presentation, as with Yue, Bjork, & Bjork (2013), who provided participants with a narrated lecture presented via a computer screen and loudspeakers. Their presentations were accompanied by either full text, abridged text, or non-matching text. Yue et al. (2013) found that recall was improved when subjects were presented with text which varied slightly from the narration. Their findings may be attributable in part to the provision of time for participants to reread the abridged text between the sections of pre-recorded narrations. This does not commonly occur in lectures, where the lecturer usually maintains a coherent flow of speech without interjecting periods of silence in which to read slides. As with many published studies which investigate the efficacy of visual aids, Yue et al. (2013) undertook their study in a laboratory environment and used individual computers to present the displays. Similarly, none of the reports included in Adesope & Nesbit's (2012) meta-analysis employed a live lecture format, and I have been unable to find any published research which compares concurrent speech and text, with speech-only, or with text-only.

An interesting alternative to a 'live' lecture environment was created by Craig et al. (2002), in which they added an on-screen 'agent' in the form of a cartoon figure who purported to deliver the verbal commentary. They found the 'agent' produced no significant impact on learning; a result also found by Clark & Feldon (2005) in a similar experiment. It might also be noted that the on-screen agents required minimal eye movement on the part of the viewer, and did not present gestures or

facial expressions as would be perceived from a 'real' lecturer, and as such are likely to have created minimal split attention.

Moreno & Mayer (2002) obtained results which appear to contradict the presence of a redundancy effect during simultaneous delivery of speech and text. Moreno & Mayer (2002, Experiment 1) compared recall of students who had listened to a verbal explanation of how lightning occurs, with that of students who received the same narration but with additional on-screen text which comprised identical words. They recorded an increase in retention, transfer, and matching skills from those who received narrative-text compared with those who listened to narrative-only. The researchers conclude the practice of providing text and narration may promote '*broader learning*' if no other visual material is present (Moreno & Mayer, 2002, p. 163). This finding is particularly important to this thesis because the findings contrast with the studies and theories cited above, and suggests that in some circumstances on-screen iteration of a lecturer's exact words may improve both retention and comprehension.

Moreno & Mayer's (2002) results raise questions regarding the concurrent processing of auditory text and visual text. They suggest,

'Because visual working memory and auditory working memory work as independent processors, additional processing capacity is made available...when two modalities are used' (Moreno & Mayer, 2002, p. 162)

Mayer (2005a) later explained the result in more detail, and cited a 'dual channel principle' in which he linked DCT with WMT. Mayer (2005a) accepts that his reasoning presents a clash between existing theoretical concepts in that DCT places spoken and printed words together, whereas according to WMT, initially at least, words and text are channelled separately. Mayer (2005a) notes the difference centres around the processing of printed words, and adds that he has opted to '*compromise on the two modalities*' (Mayer, 2005a, p. 34).

However, as with Yue et al. (2013), Moreno & Mayer (2002) allowed temporal pauses during the periods that participants were exposed to the material; these had no purpose and occurred only because of the absence of a third variable (an image) in Experiment 1, and it is possible the subjects automatically made use of such pauses to rehearse the content. Additionally, Moreno & Mayer's (2002) experiment

took place in laboratory conditions in which there was no visible narrator. Mayer (2005a) suggests the split attention effect (Chandler & Sweller, 1991) is removed in this environment due to an absence of attentional conflict, thus freeing visual processing power. Moreno & Mayer's (2002) study employed computer screens and loudspeakers, and the impact of concurrent speech from a 'live' lecturer and text displayed in a common frontal plane is yet to be fully researched. The presence of a lecturer (as distinct from a disembodied voice) is crucial to any consideration of attentional demand in a live lecture, due to the acuity of visual perception of speech signals by listeners (Massaro, 1998; McGurk & MacDonald, 1976; Tiippana, Andersen, & Sams, 2004). Such competing visual demands may create a split attention effect; a variable which might also be affected by proximity to students and by the intensity of gestures and expressions employed by the lecturer.

Whether it is possible for spoken words to be processed concurrently with speech when a learner is presented with both modes simultaneously remains unclear, and Mayer accedes additional research is necessary to clarify the nature of the difference between the two channels. This question is investigated further in the Modalities

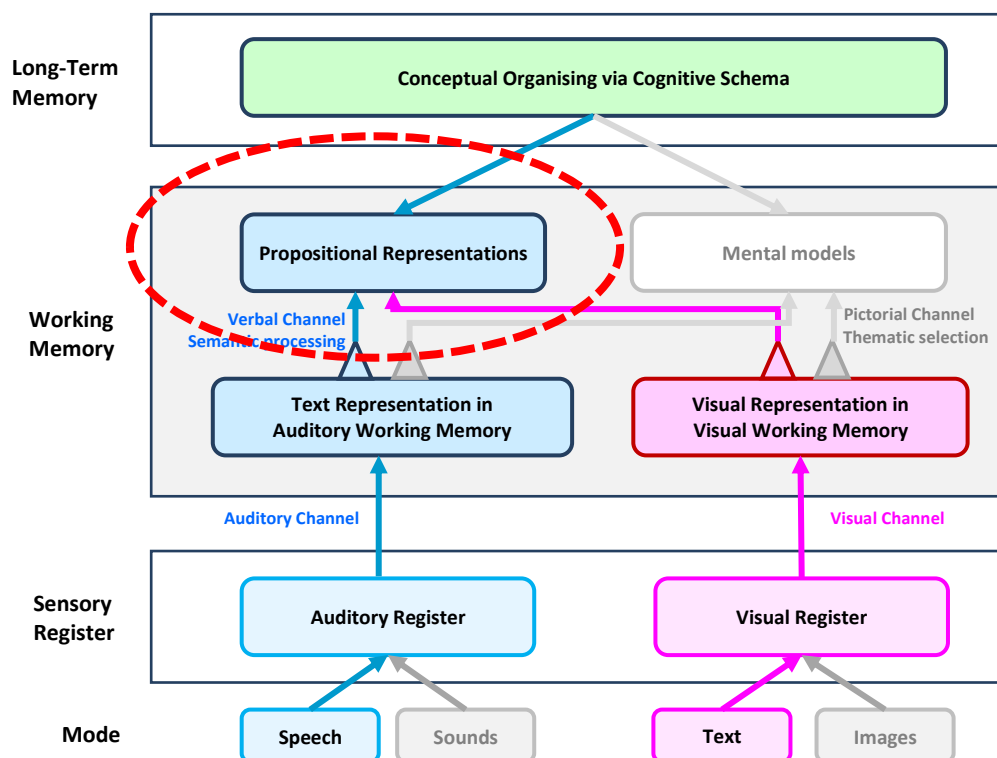


Figure 2.10. ITPC (Schnotz, 2005) applied to simultaneous speech and text (non-active areas greyed out).

exploratory and main studies reported in Chapters 7 and 9.

The Integrated Model of Text and Picture Comprehension (ITPC) offers an alternative explanation with regard to the processing of text. I have adapted Figure 2.10 from Schnotz (2005) to show the ITPC as it applies to the simultaneous presentation of speech and text (areas concerning images and non-speech sounds are greyed out for clarity). Here it can be seen that for Mayer's (2005a) proposition regarding the concurrent processing of text and speech to be correct, such processing would need to take place within a single element of working memory (circled in broken red in Figure 2.10). The minimalist Lessig method (Reynolds, 2005a) presents a carefully timed display of single words or short phrases which are concurrent with speech word for word, and it is possible that interference may be minimal with this technique. However, it is not clear whether concurrent processing is possible for inevitable differences in pace between speech and reading for longer sections of text, or for differences in syntax as suggested by Yue et al. (2013), partly because of the difficulty inherent in an attempt to synchronise the delivery of two language modalities. Consistent with the ITPC model, Gazzaniga, Ivry, & Mangun (2009) also posit that reading and auditory comprehension share common processes in the later steps of comprehension (Figure 2.11), which would interfere with each other if presented simultaneously.

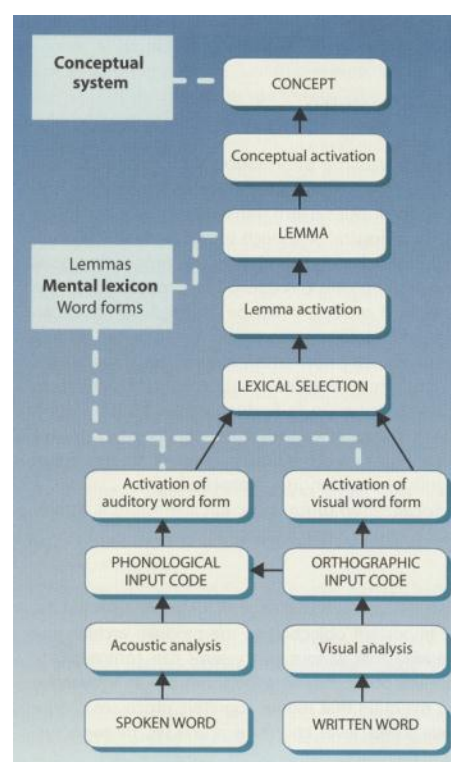


Figure 2.11. Comprehension of spoken and written language (Gazzaniga, Ivry & Mangun, 2009)

Schnotz (2005, p. 66) offers a further explanation for the processing of text; he postulates that for skilled readers, reading may not utilise the visuo-spatial sketchpad and instead use its own channel to process text. It remains unclear whether such a third route would permit concurrent processing of speech and text, particularly in a lecture environment in which high demands are placed on working memory.

It was noted in Section 2.4 above that faces known to a viewer can have a strong influence on attention (Knobloch et al., 2003), and an affective element may be present if a voice is known to the listener. Researchers do not record, whether the narrator's voice was known to the subjects, and such a connection (if perceived as a positive affect) may impact upon students' willingness to learn (Chamorrow-Premuzic, Furnham, Christopher, Garwood, & Martin, 2008; Lewicki, 1985).

Many ITT and presentation skills trainers advise the use of minimal text on slides, and although Moreno & Mayer (2002) suggest that live PowerPoint presentations may benefit from on-screen text, Mayer later modified this advice to '*short sections of text*' (Mayer & Johnson, 2008, p. 385). Clark, Nguyen, & Sweller (2006) refer to the findings of Moreno & Mayer (2002) and Kalyuga et al. (2004), and also recommend that on-screen text is limited to short segments, although they provide no further information or evidence and concur further research is required in this area. Adesope & Nesbit (2012) note presentations with brief text sections have been associated with greater learning when compared with those which contain fully redundant narration; although they suggest the key role of such a technique may be to signal to learners which information is relevant.

It was noted earlier in this chapter that the repetition of learning material in a different modality cannot automatically be assumed to help students learn, and it is interesting to note that almost half a century after Mondfrans & Travers (1964) made observations to this effect, the situation does not appear to have altered markedly. Adesope & Nesbit (2012) conclude teachers and instructional designers,

'lack a comprehensive account of the different conditions under which spoken-written materials facilitate or inhibit learning and have little empirical guidance toward a theory of how learning processes are affected by verbal redundancy' (Adesope & Nesbit, 2012, p. 251)

The majority of the literature cited in this chapter does not support the display of textual summaries concurrently with speech. Given the reported propensity of this mode of visual support (Koeber, 2005; Mann & Robinson, 2009; Pippert & Moore, 1999), there is a need for further research in this area. Mayer (2005a) and Schnotz (2005) also suggest more investigation is required, and this thesis aims to make a contribution to the debate.

A variation of simple text-summaries as a visual aid is proposed by Morley, Atherton, & Oulton (2012); they suggest the incorporation of 'visual cognitive dissonance' by the creation of slides which contain a significant proportion of images, but which do not in themselves make sense to students. They explain that students are then able to resolve the dissonance created with the aid of the lecturer, and in doing so engage more deeply with the content.

Note-taking

Reports of students' appreciation of text displayed during a lecture may be linked to note taking, which can be a demanding process (Kellog, Olive, & Piolat, 2007; Piolat, Thierry, & Kellog, 2005), and it is understandable that students wish to have key areas of learning identified for them. Armbruster (2008) notes it is difficult for students to process lecture information at the same time as note-taking due to competing demands on attention. Kiewra (1989) found that students left to their own devices often record less than 40% of the key points from a lecture in their notes, so the provision of notes such as those printed from PowerPoint 'handouts' option may have a role in fostering student engagement. The practice may be rendered more functional by the provision of some form of activity, such as missing sections or blank matrices to be completed by students. Visual aids aim to assist comprehension through the visual medium, but the activity of note-taking fulfils a different role, such as engaging the learner with the material and providing paper-based storage of key points for revision at a later time (Kiewra, 1989).

Some studies which have recorded improvements in learning outcomes when lectures supported by PowerPoint are compared with those illustrated by OHT, have attributed the results to the availability of lecture notes, provided either before or during the lecture. For example Lowry (1999) found a significant and sustained improvement in students' performance following transfer of visual displays from OHP to PowerPoint, because the newer version included slide copies as handouts. Additionally, Lowry's (1999) study involved a significant redesign of the content from its OHT origin, including the provision of preparation tasks for students during the preceding week; a factor which was absent in the OHT version.

The provision of slides via a university intranet prior to a lecture has become a relatively common practice in undergraduate study; Levasseur & Kanan Sawyer

(2006) note it is often a significant factor in improving student learning. They suggest this may be because learners have additional time to process the information, so are able to spend more time listening during the lecture. Mann & Robinson (2009) stated that, in their opinion, '*The real power of PowerPoint seems to come with combining it with the handout*' (Mann & Robinson, 2009, p. 255). Not everyone subscribes to this view; Parks (1999) believes slide printouts induce passivity among his students because they no longer need to take notes due to key areas having already been defined for them, a concern echoed by Jones (2003). James (2006) noted that while their faculty held similar fears to Parks (1999) and Jones (2003) regarding student passivity or non-attendance, the students did not share this negative assessment.

Burke, Ahmadi, & James (2009) and Roehling & Trent-Brown (2011) suggest a key benefit of text summaries may lie in helping students establish the key points in lectures, and in aiding revision for examinations. It should be noted that lecturers were able to provide printed lecture notes for many years prior to the availability of presentation software, yet the practice appears to have become more widespread since the inception of PowerPoint; possibly influenced by the ease with which such notes may be printed directly from a set of slides. Appreciation of this factor may be reflected in student feedback to their lecturers, and thus indirectly encourage the continued provision of such slides as visual aids. However, Pippert & Moore (1999) observed students' difficulty in writing down the contents of text-based slides while listening to a lecturer, and the effect of such competing cognitive demands have been recorded by others (see for example, Piolat et al., 2005).

Onscreen text summaries may assist students whose attention has wandered, or those who wish to go over the lecturer's key points again; although concentration on a textual summary of a previously discussed point may interfere with that which is currently being articulated. Adams (2006) reinforces this notion, and records comments in which an undergraduate student describes how, after reading all the points contained on a slide, he has then missed the last section of what the lecturer said.

2.6 Depiction of abstract topics

Emerson believed,

‘...every word which is used to express a moral or intellectual fact, if traced back to its roots, is found to be borrowed from some material appearance’.

(Emerson, 1849)

and Damasio (2006) suggests,

‘Most of the words we use in our inner speech, before speaking or writing a sentence, exist as auditory or visual images in our consciousness. If they did not become images, however fleetingly, they would not be anything we could know’. (Damasio, 2006, p. 106)

Thus it might be deemed that most abstract topics possess some attribute which might be depicted in the visual modality, whether by presentation of an image or stimulation of imagery on the part of a learner, and I have described above how visual representations and imagery might aid learning.

Laurillard (2002) observes that academics often want students to learn more than that which is already

available from experiencing

the world, and this may be more than can readily be displayed in a visual depiction.

Sadoski (2001) notes that in general, newly acquired abstract material tends to be poorly recalled, even if it is known by the learner to be important. Table 2.1

indicates that according to DCT, dual coding may not take place with words that are abstract in nature. This suggests a depiction which supports understanding and recall may have a role in the learning of abstract concepts.

The Context Availability Hypothesis (Schwanenflugel, 1991) suggests both concrete and abstract words are represented in a single code, and that the processing of a word depends either on preceding discourse or on the content of an individual’s own long-term memory. Kousta, Vigliocco, Vinson, Andrews, & Del Campo (2011) have suggested DCT does not account for findings which indicate abstract words may possess a lexical advantage due to possession of emotional valence. This is an area which warrants further research, and the debate in this arena continues (Paivio,

Table 2.1. Coding according to concreteness (Paivio, 1979)

Stimulus	Coding system	
	Imagery	Verbal
Picture	+++	++
Concrete word	+	+++
Abstract word	-	+++

2013; Vigliocco, Kousta, Vinson, Andrews, & Del Campo, 2013). Of significance to this thesis is the suggestion that emotional valence may have an important effect on abstract words, by the provision of non-verbal coding. In this case, the advantage of concrete words over abstract suggested in Table 2.1 may not be as clearly defined. Although this thesis is concerned with visual support for learning, it may be that other forms of salience such as emotion may be equally valid in providing additional coding when used in support of speech, as implied by Kousta et al. (2011). Kiefer & Pulvermuller (2011) suggest a dichotomy between abstract and concrete concepts may not be justified, because abstract concepts are typically embedded in concrete situations which can be experienced, and Macoir (2009) suggests concreteness and abstractness should be considered as a continuum between two ends of highly concrete and highly abstract concepts. Lakoff & Johnson (1980) also note the abstract is grounded in concrete domains. They describe how metaphor permits an understanding of one kind of experience in terms of another, and that such a method utilises visual working memory (Lakoff & Johnson, 1980). Bergen (2012) suggests that even when abstract language is not metaphorical, we may build our own mental metaphorical simulations. Barsalou & Wiemer-Hastings (2005) suggest that for 'every-day' abstract concepts, learners refer to concrete situations when thinking of them. Clearly, much that is discussed in undergraduate lectures is not 'every-day', and Laurillard (2002) refers to the 'second order' character of abstract knowledge as once removed from experience, and which is also likely to be once removed from that which can easily be depicted.

Depiction or representation of an abstract concept may not be straightforward in terms of obtaining an image from an Internet search or library, but for those who possess drawing

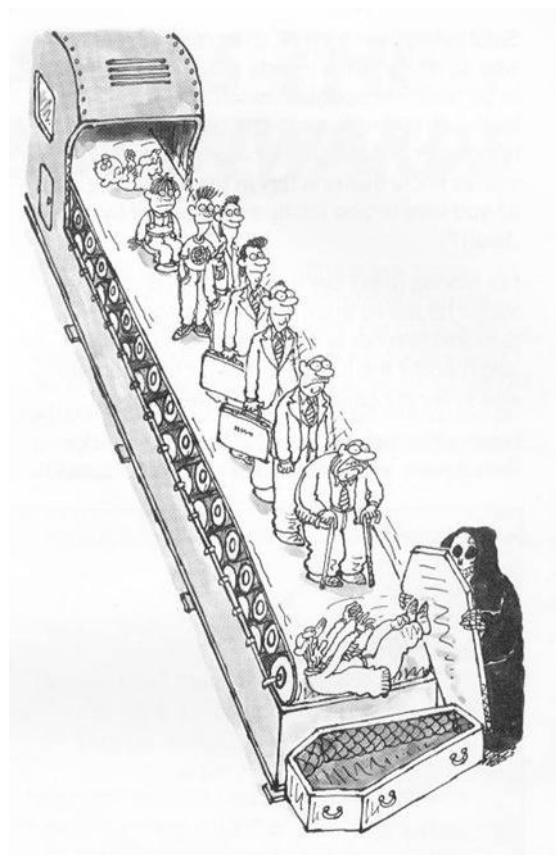


Figure 2.12. Representation of abstract notion (Kirkwood, 1988)

skills, a visual rendition may be possible. For example, Kirkwood (1988) links abstract concepts of religious belief to concrete representations through the medium of cartoons. In Figure 2.12, he provides a visual metaphor for a potentially meaningless [human] life in the form of a short conveyor belt which moves from birth to death (Kirkwood, 1988). The metaphorical shrinking of a lifetime into a ten metre journey provides a visual impact and affect that would otherwise take many words to express. Eppler & Burkhard (2006) espouse such a concept by referring to 'heuristic sketches' which are used to,

'assist the group reflection and communication process by making unstable knowledge explicit and debatable'. (Eppler & Burkhard, 2006, p. 11).

Religious education has a long history of teaching abstract concepts; often to those who were illiterate and whose vocabulary may have been limited. Although, as with the statistical representations of McCandless (2010), such artistic interpretation and drawing may require a level of skill beyond that possessed by many teachers and lecturers.

Pippert & More (1999) found multimedia materials were less helpful in boosting students' understanding of abstract theoretical models than concrete conceptions, although the researchers did not elaborate on the visual content employed, or whether any difficulties were encountered in the creation of suitable visual materials as encountered by Prabu (1998). The difficulty inherent in the visual representation of abstract concepts may underpin many lecturers' reliance upon text summaries as visual aids, and the visual support of abstract concepts in lectures warrants further research.

2.7 Reality simulation and imagination

Teachers and lecturers may use descriptive language when they provide examples, share anecdotes, and tell stories, and the use of such techniques is likely to generate images in the minds of their students. This section considers the merits of such methods.

The notion that memory may sometimes be a confabulation of real and imagined artefacts has been recorded in literature; Siegfried Sassoon described how, when he pictured scenes from his childhood later in life, he saw both himself and his imaginary friend in the mental image (Sassoon, 1928). Richardson (1999) noted

good imagers are sometimes unable to differentiate between genuine memories and plausible fictions, and this phenomenon is well reported in the research literature (see for example, Dallet & Wilcox, 1968; Intraub & Hoffman, 1992; Johnson & Raye, 1981; Peeck, 1989). Dallet & Wilcox (1968) presented subjects with either a photograph, or a paragraph of descriptive text, and one week later asked them to recall whether they had viewed a picture or read a paragraph. The researchers found that some participants who had only read a paragraph recalled having seen a picture, yet the reverse did not apply; no-one who had been shown a picture recalled reading a paragraph of text. Intraub & Hoffman (1992) showed subjects a mixture of printed paragraphs, and paragraphs accompanied by colour photographs. Upon reading paragraphs not associated with pictures a week later, 38% recalled seeing a photograph when in fact they had seen no such image. Some of Intraub & Hoffman's (1992) participants were even able to draw their 'remembered scenes' on paper; indicating that for them, although they had not seen a photograph, there existed a residual visual reality which they were able to reconstruct seven days later. Intraub & Hoffman (1992) conclude their research validates the 'reality monitoring' model of Johnson & Raye (1981), in that reality 'errors' can be induced in the minds of participants. Peeck (1989) similarly found that after a delay, learners were unable to remember whether they had seen a picture or read descriptive text. This effect might be employed in a lecture environment when practicalities limit that which can be created for a visual display, and a lecturer may be able to stimulate a visual experience, and thus create an associated image in long-term memory.

Following Galton's (1880) classic investigations into imagery, in which he identified variations in individual abilities to imagine scenes such as their breakfast table on the morning of the day in which the question was posed, Betts (1909) investigated the different degrees to which imagery was used by subjects when asked to resolve mental three-dimensional puzzles. Perky (1910) demonstrated links between imagery and perception in the early twentieth century in a classic experiment in which individuals were effectively tricked into believing barely visible projections on a screen in front of them were actually their own mental creations. As a result of experiments such as these, the power of imagery and its comparability with perceived images was established.

Marks (1973) and Farah et al. (1988) later concluded that imagery may be created by the same sections of the brain responsible for the perception of stimuli via the eyes. However, this simplified model is no longer widely accepted. Kosslyn & Thomson (2000) used incomplete pictures for comparison of mental stimulation on the basis that visual imagery is not hallucination, and the researchers wished to provide images of similar quality to those produced by imagination. Kosslyn & Thomson (2000) found that visual perception and mental imagery share many common brain mechanisms, and more recent research has confirmed the majority of such mechanisms are activated during imaging (Ganis, Thompson, & Kosslyn, 2004). When Ganis et al., (2004) provided fMRI subjects with imagery tasks which were similar in nature to perception tasks, they found 92% of the same brain areas were activated in visual mental imagery as in visual perception.

Kosslyn (2007b, p. 101) describes the summoning of a mental image as '*top-down filling-in*' and perception of a scene as '*bottom-up perception*'. He refers to the ability to create a mental image as '*Reality Simulation*' (Kosslyn, 2007b, p. 94). Degrees of vividness experienced by an individual are likely to be a reflection on the amount of sensory detail available from either working or long-term memory (Baddeley, 2007). Differences in vividness of imagery experienced between individuals have been accepted since the studies carried out by Galton (1880) and Betts (1909). Yet Di Vesta, Ingersoll, & Sunshine (1971) found a key correlation between vividness of imagery was social desirability in the form of a desire on the part of subjects to please the experimenter.

The first part of the brain to receive information from the retina via the optic tract and lateral geniculate nucleus is known as the primary visual cortex, early visual area, or area V1. Of particular significance to the stimulation of imagery during a lecture is the notion that later visual areas may be able to drive neurons in early visual areas; in other words, had the macaque monkey whose brain section is shown in Figure 2.9 been able to visualise a web-shaped pattern, it is possible it may have created a similar, albeit fainter representation in the early visual area (Ganis, Thompson, & Kosslyn, 2009). Kosslyn (2003) suggests that as approximately two-thirds of the same parts of the brain are involved both in both visual mental imagery and visual perception, the brain does not always remember where the impetus came from. The notion that the primary visual cortex is involved in visual imagery is not universally

accepted and remains the subject of much debate (Moro, Berlucchi, Lerch, Tomaiuolo, & Aglioti, 2008). Kosslyn, Ganis & Thompson (2001) suggest that area V1 is activated by imagery which requires fine detail. In a meta-analysis of imagery studies, Kosslyn & Thompson (2003) found confirmation that early visual areas were stimulated by a requirement to inspect mental image details in high resolution, but such areas were not found to be stimulated when subjects were simply asked to use high resolution in general. They postulate that precise, detailed imagery is likely to require the use of area V1. That this debate remains unresolved is indicated by the findings of Bridge, Harrold, Holmes, Stokes, & Kennard (2012), who reported a patient with bilateral lesions in area V1, but who maintained the ability to experience vivid visual mental imagery; conversely, Moro et al. (2008) describe two patients, each with an intact primary visual cortex but with impaired visual imagery. More research is required to clarify the nature of imagery in the brain; nonetheless the impact of interventions such as those of Intraub & Hoffman (1992) and Johnson & Raye (1981) suggest the active use of imagery during a lecture may have a role in the absence of a visual aid. Thus, assuming relevant representations exist in long-term memory, a lecturer may have a choice of methods by which an image can be created in the minds of their students; by displaying an appropriate image, or by stimulation of an internal representation.

Leahy & Sweller (2008) build on the findings of Intraub & Hoffman (1992) and Johnson & Raye (1981); they refer to an 'Imagination Effect', and recorded a positive impact on learning when students were explicitly requested to imagine information. They reason the learners are compelled to process the image in working memory, and thus aid the construction of long-term memory.

The use of imagery to enhance sporting performance is well described in the literature; for example, Woolfolk, Parrish, & Murphy (1985) found an increase in golf putting performance following imagery of the required actions, and a meta-analysis carried out by Driskell, Copper, & Moran (1994) confirmed the technique to be effective when applied to tasks requiring cognitive operations, such as making decisions. Although the teaching and lecturing of abstract concepts may not be analogous with attempts to improve sporting outcomes, such techniques have been associated with changing attitudes. For example Blair, Ma, & Lenton (2001) found the action of subjects who visualised human counter-stereotypes produced a

moderation of attitude toward previously held gender stereotypes. The use of imagery in academic and work-based learning is not well researched, and warrants further exploration, particularly in view of the possibility that in appropriate circumstances, imagery may have an impact on memory comparable to that of a projected visual aid, but without the practical limitations of the latter in terms of design.

The concept of imagery as a mental recreation of images has been criticised by Pylyshyn (1973, 2003). He does not accept the notion that images are seen 'in the mind's eye', and has presented a counter argument to imagery theory for many years. Pylyshyn (1973) proposes an alternative view that mental images are propositional representations; a form of mental description. Although Kosslyn's model has become the dominant model in contemporary use, Pylyshyn's (2003) approach does not negate the use of imagery in the context of creating memorable support for learning.

Imagery and learning

As noted in 2.3 above, learners classified as having a cognitive style of 'verbaliser' are also able to visualise when instructed to do so, as by definition are visualisers. The impact of images passively 'brought to mind' either through descriptive speech or metaphor, or actively through instruction, are considered in this section. Lakoff and Johnson (1980) argued that metaphor comprehension is grounded in sensory experiences. Language can stimulate more of the brain than just Wernicke's and Broca's areas as originally thought (Rohrer, 2005), and is capable of stimulating motor areas related to textual or language content (Buccino et al., 2005). A sensory element of this proposition has been borne out by fMRI based studies, for example, Lacey, Stilla, & Sathian (2012) found volunteers who listened to metaphors which related to texture had the 'texture-sensing' part of their cortex stimulated.

The power of imagery in thought has been noted throughout recorded history; Socrates believed thought was not possible without an image (Morrison, 2010), and Ryle suggested we think as a combination of,

'an internal monologue or silent soliloquy, usually accompanied by an internal cinematograph-show of visual imagery' (Ryle, 1949, p. 27).

Damasio (2006) used the term '*dispositional representations*' for the reconstruction of images which can be activated '*like the town of Brigadoon*' (Damasio, 2006, p. 104), and Kosslyn (2007b, p. 95) relates a conversation with a Buddhist monk in which the monk described how his mental training allowed him to summon images which appeared '*like a fish leaping out of water*'. Kozhevnikov, Louchakova, Josipovic, & Motes (2009) note that with suitable preparation, Buddhist monks are able to maintain heightened visuospatial states for extended periods of up to several hours.

Kosslyn, Ganis, & Thompson (2006) found that during visual mental imagery, recalled images can be processed further by reinterpreting them or transforming the image spatially or in appearance. These findings suggest a carefully directed process of visual imagery on the part of a lecturer might facilitate the creation of a moving image in students' minds. Although unlikely to be as practised as Buddhist monks, if students are able to summon illuminating and relevant representations from within their own minds, there may be no benefit brought about by the display of an image. In this case it is possible that a depiction may become redundant and interfere with an internally generated image (Schnitz, 2005). The notion that a presented image might interfere with the production of internally generated images was espoused by the literary critic Thomas Craven who wrote, '*all illustrations are disappointing*' (Bluestone, 1957, p. 23) because he believed readers do not visualise directly, but relate character descriptions to themselves.

Many of us have experienced the effect of being so absorbed in a novel that we have temporarily lost a sense of awareness regarding our immediate surroundings. Green & Brock (2002, p. 315) name this effect '*Transportation-Imagery*', and if such transportation is initiated in a lesson or lecture, it may have a lasting effect on recall linked to the reality simulation findings of Johnson & Raye (1981). As noted by Richardson (1999), the degree to which this happens may depend on the imagery skill of the individual, and it is possible the quality of the narration may also be a factor. The novelist Daphne Du Maurier was a notable exponent of this technique. Du Maurier encouraged her readers to indulge in a high degree of imagery by a combination of visual language and writing in the first person (Sillars, 1995). It is possible that student engagement may be fostered with some topics by the use of

such a technique, and the impact on learners who place themselves within an imagined scenario is investigated in the Modalities main study reported in Chapter 9.

Paivio (2007) developed a 'Conceptual Peg Hypothesis' to describe the creation of a concrete entity or 'peg' in learners' minds on which to 'hang' a newly introduced idea or concept. He posits the concreteness of such a 'peg' increases retrieval access to the concept. Paivio (2007) believes images are the most effective mode for conceptual pegs, and he notes that imagery has been a basis for memory for 2,500 years, and cites its use by Simonedes in ancient Greece, who first described the method of loci. Paivio (1991) notes that when using memory techniques to remember words, imaging encourages the concretisation of abstract words. He suggests,

'Lessons containing concrete information and evoking vivid images will be easier to comprehend and remember than lessons that are abstract and not image-arousing'. (Paivio, 1991, p. 173)

The efficacy of instructions to use imagery have been studied in the area of learning and memory; some researchers have limited their instructions to simply requesting participants to *'use imagery'*, others have provided more specific instructions, such as Anderson & Kulhavy (1972, p. 242), who instructed one of their participant groups to *'form a vivid mental picture'*, and Denis (1982, p. 544, Experiment 4) who provided detailed instructions to *'construct visual images as rich and vivid as possible for places, characters, and actions'*. Denis (1982) found the provision of specific instructions which related to vividness improved imagery results for participants identified as low

imagers, and resulted in a parity for recalled narrative material between this group and another group identified as high-imagers but who did not receive instructions.

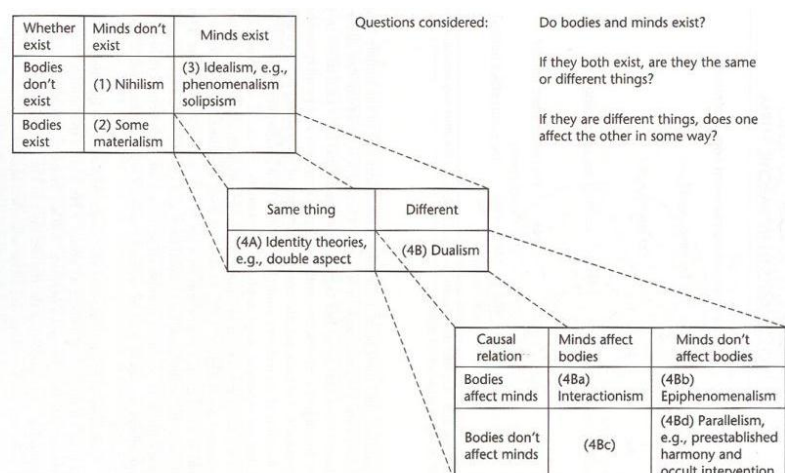


Figure 2.13. Graphic organiser (Bligh, 2000)

This finding offers insight into how such techniques might be employed in teaching, although its use in an environment outside of a laboratory setting is not well reported.

High quality imagery may not improve comprehension and recall automatically; Knauff & Johnson-Laird (2002) found vivid imagery which was irrelevant to the task slowed and impeded reasoning in their subjects. Stull & Mayer (2007) found that learning in which graphic organisers were presented visually showed improved retention compared with situations in which learners were asked to create their own sketches of such organisers. Schwaborn, Thillmann, Opfermann, & Leutner (2011) found that learners asked to generate their own pictures seemed to have less cognitive resource available with which to process new information, and resulted in reduced comprehension. This suggests the use of imagery should be proportionate to the cognitive demands placed on the learner. Presentation of a graphic organiser as shown in Figure 2.13 may thus reduce extraneous cognitive load and allow for other processing tasks to be carried out by visual working memory.

The ability to self-generate images was succinctly summarised in a response received in an interview by the broadcaster Alistair Cooke in the 1940s, in which a seven year old boy was asked whether he preferred television or radio. The boy replied that he preferred radio because *'the pictures are better'* (Wasko, 2005, p. 9); his ability to imagine outshone that which could be created on television. The limitations of that which can be portrayed on screen have now largely been overcome by computer generated imagery techniques (CGI). Nonetheless, the creation of CGI is expensive and technically demanding, and may remain out of reach of many educational establishments for the foreseeable future.

Concrete language

A degree of imagery on the part of a student may be initiated by the careful selection of language, for example by the use of concrete or emotional words to make an abstract concept more memorable, or the application of simile or metaphor. Sadoski (2001) found the addition of imagery and descriptive language made material easier to recall and more interesting for learners. In experiments in which narrative passages from history text books were revised to make them more concrete and imagery-invoking but without changing the meaning, the researchers recorded

improved understanding and recall (Sadoski, 2001). Earlier, Sadoski, Goetz, & Fritz (1993, Experiment 1) compared abstract sentences such as,

‘Georgia O’Keefe’s career covers most of the history of modern art in America, and she shares the inner world of reflection with the earliest modernists’,

with an adapted sentence comparable in length, readability and informative content, but which had been ‘concretised’:

‘Georgia O’Keefe perceived art everywhere - she once purchased a house because she admired the way a black double door was placed in a long, adobe wall’. Sadoski et al.(1993)

Sadoski et al. (1993) found such concretised sentences were recalled more than twice as effectively when subjects were tested immediately afterwards, and recorded a similar improvement in recall when tested five days later. However, it might be noted that these two sentences are actually not informationally equivalent as defined by Tabachneck-Schijf & Simon (1996); for example, there is no mention of O’Keefe’s place among early modernists in the concretised version. If, as Bligh (2000) suggests, a lecture should be more than simple transfer of information, and the task of a lecturer is to add to that which students could simply read for themselves, then the effect of concretising an abstract concept may be, to paraphrase Sadoski et al. (1993), to effectively place a ‘door’ on the ‘wall’ of their subject.

2.8 Discussion

Much of the research reported in this chapter with regard to the perception of images and text has utilised laboratory-based experiments, and since the 1990s many of these have been undertaken by the provision of computer-based equipment for each participant. In such investigations a teacher or lecturer is necessarily absent, but in a live lecture the lecturer presents an additional and separate demand on student visual attention. Consequently a lacuna exists in the literature with regard to the use of the visual medium in a learning environment which already contains an active visual medium in the form of a lecturer. Thus a place exists for research which seeks insight transferable to the post-compulsory classroom and lecture room, in particular with regard to the presentation of text concurrently with a lecturer’s speech.

As described earlier in this chapter, advice from popularist literature frequently suggests images may help learning for visual learners, and although some of these claims are unsubstantiated, peer reviewed literature appears to confirm working memory capacity may be enhanced by the judicious addition of a visual component during a lecture, with the caveat that such provision should be task-appropriate (Schnotz & Bannert, 2003). However it is unclear from the literature exactly how a lecturer might decide what constitutes 'task-appropriate' as opposed to merely 'relevant'; a commonly cited guideline to utilise stock images from the Internet (Atkinson, 2005a) does not naturally accord with the advice of Schnotz and Kurschner (2007) that instruction should aim to match human cognitive architecture. Nonetheless, established models of memory support the notion that utilisation of visual images or concrete language should improve learner retention and understanding by employing visual processing capacity.

Much of the available literature which offers guidance in the creation and use of visual aids in general and of Microsoft PowerPoint in particular, relates to business presentations and as such may not be considered particularly relevant by professional teachers and lecturers. The literature is unclear regarding the value of text as a visual aid, and the quantity thereof which is optimal to support learning. Reports of student appreciation of text as an aid for pre-lecture preparation and for later revision are difficult to separate from its value as a visual aid during the lecture itself. The findings from this chapter also suggest that lecturer-instigated mental imagery for students might aid learning by the utilisation of visual working memory.

Despite the gaps in the literature identified above with regard to visual aid content, there exist theories and disparate areas of published research which, together suggest a greater planned use of the visual medium might be productive, and that an investigation which combines these notions in a live lecture environment might provide insight which is both valuable and transferable.

2.9 Conclusion

This chapter has investigated the information readily available to teachers and lecturers regarding the design and use of visual aids. It has found that which is available to be limited in its accessibility, and sometimes overshadowed by a co-existence of popularist literature, some of which is confusing, and at times

contradictory. The chapter has examined three established theories of memory, and a further two contemporary theories of text and image comprehension and related these to the use of visual aids in live teaching environments. It has concluded that although theories of memory support the display of task-appropriate image-based visual aids in post-compulsory education, the extent to which the simultaneous provision of speech and text might support learning remains unclear. Some of the literature suggests such dual presentation of language may interfere with mental processing although it remains unclear how this might be quantified in a way that provides guidance for lecturers. A lacuna thus exists in knowledge regarding the efficacy of text displayed in support of a lecture which warrants further research. The chapter has also found that it is unclear how images might best be used in post-compulsory teaching and lecturing and proposes this as an additional area for further research. It has widened the concept of visual aids to include imagery stimulated by a lecturer, and has indicated that inclusion of this modality in the Modalities main study may provide additional insight.

The next chapter reviews the literature which concerns what is known about how teachers and lecturers use visual aids; what their content comprises, and on what they base their design choices.

Chapter 3 What do lecturers do? Literature review

3.1 Introduction

One might suppose that the long history of visual arts in society, and recent advances in the understanding of visual perception, might have combined in the 21st century education to produce visual aids which are routinely carefully designed and adapted for a teaching environment. This chapter examines the degree to which this is the case and investigates teachers' and lecturers' use of visual aids as represented in the research literature. It traces the changing nature of visual displays since the introduction of computers and digital projection devices to classrooms and lecture rooms, and analyses the influence of such technologies. The chapter also inquires into what is known about teachers' and lecturers' knowledge and proficiency in the design, creation and use of visual aids, and makes recommendations for further research.

3.2 Setting the scene

Lectures have been used as a teaching method in higher education for at least eight hundred years (Laurillard, 2002), and devices which can project images for audiences in lecture theatres have been available for approximately three hundred and fifty years (Mannoni, 2000). However in the mid-20th century, Bloom suggested all was not well; he recorded that approximately 31% of students' thoughts during lectures were irrelevant to the subject being taught (Bloom, 1953). One might expect the development of technology in lecture rooms since the 1950s, from coloured pens and whiteboards, overhead projectors (OHPs) to contemporary multimedia systems able to display an almost unlimited array of visual representations, should have made a positive impact on student interest and engagement. This expectation has not been fulfilled, and in 2002 Laurillard (2002, p. 93) described lectures as a '*grossly inefficient way of engaging with academic knowledge*', and she suggests lectures be scrapped altogether as a teaching method due to their limitations and the burden placed on students to create learning in lectures via their own thought processes. Mann & Robinson (2009) reinforce Laurillard's (2002) observation; they discovered in the first decade of the 21st century that many students do not find their lectures to be engaging. The researchers surveyed 211 students from an English university and recorded that 59% found their lectures to be '*boring*' half of the time, while a further 30% categorised '*most or all*' of their lectures in this way (Mann &

Robinson, 2009, p. 253). It is not the role of a lecturer to be 'entertaining' in order to engender student appreciation, and many factors contribute to such findings; for example the nature of the subject matter, and the proneness of individual students to boredom. A lecturer's personal approach to teaching may also impact on such a measure, for example if they regard teaching primarily as a transmission of information (Trigwell & Prosser, 1996); an approach which has been linked to the adoption of surface approach to learning by students (Trigwell, Prosser, & Waterhouse, 1999). Mann & Robinson's (2009) findings are important because boredom brought about by the application of teaching methods which do not stimulate students has been linked to the achievement of lower grades (Bartsch & Cobern, 2003). Of particular relevance to this thesis is Mann & Robinson's (2009) finding that one of the key factors which contributes to students' disaffection is their experience of PowerPoint-based visual aids. Computer-based presentation software such as Microsoft PowerPoint has been available since the mid-1990s (Gaskins, 2007), yet as noted in Chapter 2, the modality is often criticised, and at its worst earns the moniker '*Death by PowerPoint*' (Garber, 2001). This chapter investigates the literature in search of insight as to why this situation might prevail.

Almost all the available research into the arena of digitally produced visual aids in the classroom and lecture theatre investigates the use of Microsoft PowerPoint by name, and this eponym is used throughout this thesis. It is important to note that the visual displays investigated in this thesis could equally well have been created using other software packages, in particular Apple Keynote, which is favoured by users of Apple computer equipment. Microsoft Office Suite includes PowerPoint presentation software, and in 2011 Microsoft estimated there were 750 million users of Office Suite worldwide (Microsoft, 2011). In 2006 it was estimated that between 10^{10} and 10^{11} PowerPoint slides were created yearly (Tufte, 2006), and it is likely this number has increased in the ensuing years. Whilst not all schools and universities necessarily use Microsoft Office, most possess a commensurate form of presentation software such as Keynote. These software applications allow users to create and display a variety of two dimensional 'slides' in sequence, and each manufacturers' version contains slight differences in design. Other specialised software such as 'SlideRocket', 'Prezi', 'Gapminder', 'SlideRocket' and 'PowToon'

are relatively recent additions to the field of visual aids and as yet do not regularly feature in published research.

Despite PowerPoint installations being counted in their millions, many writers comment that research is lacking into its use in teaching and lecturing, for example Christie & Collyer (2005) observe it has been under researched compared to the use of multimedia in which students interact directly with a computer. Ricer, Filak, & Short (2005) similarly note the area to have been under researched, and Craig & Amernic (2006) describe the number of authoritative studies as surprisingly small given the widespread adoption of the software. Others have noted that a void in the literature remains (see for example, Lane & Wright, 2010; Stewart, Cipolla, & Best, 2009). Despite such observations, investigation continues into the use of PowerPoint as a modality in its own right, although Roehling & Trent-Brown (2011) concede these are still in their early stages. Of particular relevance to this thesis is the observation of Berk (2011), that what little research is available is not reflected in classroom practice. The similarities evident in the findings of Bloom (1953) and Mann & Robinson (2009) suggest a lacuna may have existed in the literature over many years regarding the design of visual support for learning.

The investigation of educational media without reference to content is not unknown in the literature. Clarke (1983) notes that research into the efficacy of radio as a learning aid in the 1940s, and similar investigations into the use of television in teaching in the 1960s, tended to concentrate on the medium itself rather than the nature of the content. The observation that early investigations into computer-based learning maintained a similar concentration on medium whilst apparently ignoring content led Clarke (1983) to comment,

‘media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition’ (Clarke, 1983, p. 446)

A primacy of medium over content appears to have persisted among investigations which have inquired into the replacement of overhead projectors by digital technologies; much of which has not recorded the design, pedagogical purpose or quality of the displays. In a review of the research into computer generated slides in the classroom, Levasseur & Kanan Sawyer (2006) note it is difficult to tell how the

technology has been utilised *'because the research has generally failed to specify the exact nature of the slides'* (Levasseur & Kanan Sawyer, 2006, p. 117). Clarke (2008, p. 40) suggests that *'we still know little about how to use it [PowerPoint]'*; however in Chapter 2 I identified established theories which might inform visual aid design, and perhaps it would be more accurate to say, as suggested by Berk (2011), that we do not adequately share that which we know as a professional community.

3.3 Analysis of the technology

Following the widespread introduction of computer driven digital projection systems which began to replace overhead projectors in the 1990s, studies emerged which compared their effectiveness with that of OHTs (see for example, Bartsch & Cobern, 2003; Lowry, 1999; Parks, 1999; Pippert & Moore, 1999; Szabo & Hastings, 2000). The procurement of computer-based technology represented a significant financial investment on the part of educational establishments, and an assessment of its effectiveness in the support of learning was clearly warranted. The introduction of desktop computers and PowerPoint software preceded the widespread availability of data projectors by several years, and during this period visual aids were often created with PowerPoint software and then printed onto acetate for display with an OHP.

Consequently, a computer driven display might differ from a simple OHT presentation only by the actions of a lecturer, to initiate animated text by means of a keypad in the former, or to slide a sheet of paper along an acetate sheet to reveal text line by line in the latter. Thus, a comparison of overhead transparency projection with PowerPoint may record little difference in perceptual impact on the part of the learner, particularly in studies in which lecturers attempt to maintain similar slide content between acetates and digital slide sets. For example, Susskind et al. (2005) describe how they chose to provide similar slide content for each mode in their comparison of OHT with PowerPoint, and deliberately excluded frequently employed attributes of the digital medium such as making slides available online pre-lecture, and providing notes during a lecture. Similarly, Koeber (2005) described how his content remained unchanged in the move from OHT to PowerPoint, and comprised *'mostly text'* (Koeber, 2005, p. 288). Koeber (2005) converted OHTs directly into PowerPoint slides, so it is perhaps unsurprising that he did not record any increase in grades; although he did report students' increased appreciation of

the medium. Szabo & Hastings (2000) found no improvement in results brought about by a transfer from OHP to PowerPoint; despite student statements to the effect that they preferred the latter, and that they believed it had helped their learning. Bartsch & Cobern (2003) reported an increase in motivation and self-efficacy beliefs among students who attended lectures supported by PowerPoint, but as with Szabo & Hastings (2000), they found no discernible improvement in results. Savoy, Proctor, & Salvendy (2009, p. 866) noted a similar '*disconnect between performance and preference*' in groups who received the digital version. Such a 'disconnect' between performance and appreciation which resulted from a transfer of content to a different medium accords with the findings of Konigs, Brand-Gruwel, & Van Merriënboer (2007), that if teachers are not provided with guidance, they tend to implement innovations in accordance with their existing habits and approaches to teaching. Thus it is perhaps unsurprising that many studies found little difference in student achievement between lectures supported by OHT and PowerPoint, because essentially the students received the same visual material.

Some of the early studies which investigated the use of PowerPoint in post-compulsory education concede novelty may have been a factor in students' expressed preference for the medium (see for example, Lowry, 1999; Pippert & Moore, 1999); although this effect has presumably diminished post-2000, since which time the use of presentational software has become the norm in many lecture theatres and classrooms. Pippert & Moore (1999) suggested students would eventually see PowerPoint as commonplace and '*as boring as conventional overheads*' (Pippert & Moore, 1999, p. 100); and in so doing they pre-empted Mann & Robinson's (2009) findings on student disaffection linked to PowerPoint by ten years.

From the limited references to content contained in the literature, it may be deduced that researchers have predominantly (although not exclusively) employed text-based visual aids in their samples; for example, Apperson et al. (2006) describe how they chose to compare PowerPoint text with 'Chalk and talk'. The Oxford English Dictionary defines 'chalk and talk' as '*a method of teaching consisting of lectures illustrated chiefly on the blackboard*' (OED, 2011) and it might be argued the colloquialism applies in principle (if not literally) to any didactic lecture supported by a text-based visual aid, whether this is chalk and board, whiteboard, OHP or

PowerPoint. Others have made similar comparisons between 'chalk and talk' and PowerPoint, for example Daniels et al. (2008) and Kunkel (2004).

In addition to an absence of data regarding the nature and design of visual aids noted above, descriptions of intended learning outcomes are also frequently missing. Dwyer (1978) noted one of the basic criticisms levelled at media research is the contention that researchers do not adequately specify the type of learning tasks students are expected to achieve. This criticism remains valid for some contemporary investigations, and such an omission is analogous to inquiring whether a group of art students liked visiting a particular art gallery; if one omitted to mention the art on display one would remain ignorant as to exactly what it was the students appreciated.

An appreciation of lectures supported by PowerPoint may also be linked to a phenomenon Naftulin, Ware, & Donnelly (1973) have named the 'Dr Fox Effect'. An actor so named was employed by the researchers to use a range of valid rhetorical and lecturing techniques whilst delivering deliberately spurious content. The subterfuge was found to be positively evaluated by the audience (Naftulin et al., 1973). In a contemporary investigation into the impact of lecturer style on student perception undertaken by Carpenter, Wilford, Kornell, & Mullaney (2013), two groups received a lecture from the same lecturer who either stood upright, maintained eye contact and spoke fluently without notes, or slumped, avoided eye contact and spoke haltingly from notes. Carpenter et al. (2013) recorded no significant differences in a later test of recall of lecture content between the two groups, despite finding that students who had experienced the more fluent performance rated their learning more highly. Such differences in perception are particularly relevant to this thesis, as ratings of student preference may not always represent an accurate representation of the learning that took place.

None of the above studies indicate whether the slide sets were made with ready-made templates available within PowerPoint software, or if they were created from blank slides. Tufte (2006) is a much cited critic of PowerPoint, and believes what he refers to as '*Microsoft's cognitive style*' (Tufte, 2006, p. 30) should not be imposed on communicators. Referring to PowerPoint's default template, which encourages the creator to arrange sections of text into 'levels' of order by means of boxes and

indents, he suggests most users automatically follow this layout rather than designing their own. Perhaps the ultimate criticism of the use of such templates is contained in Tufte's (2006) suggestion that the use of PowerPoint's default layout contributed directly to the 2003 Columbia Shuttle disaster, in which a misjudgement of risks (which had been presented to the ground-based engineering team in a PowerPoint presentation) led to the shuttle breaking up on re-entry to the atmosphere (Tufte, 2006). Not everyone agrees with this analysis however, and media experts have criticised Tufte for confusing cause and effect, and accuse him of attempting to blame PowerPoint for the faults of its users (Atkinson, 2004). In an interview with Atkinson (2005b), Mayer points out that it does not make sense simply to refer to PowerPoint as a 'method' for this reason, because the software is actually capable of a wide range of visual representations (Atkinson, 2005b).

Kinchin (2006) compares the use of PowerPoint with word processing software, and suggests it would not be reasonable to blame a poor novel on the inadequacies of Microsoft Word. Kinchin's (2006) analogy implies that an author who is capable of writing a good novel will do so, regardless of the limitations or capabilities of the software. This analogy might similarly be applied to lecturers who wish to prepare a lecture with PowerPoint. Yet Adams (2006) suggests teachers do not make such choices for themselves; she believes they often follow the options proffered by PowerPoint's templates. The influence of templates is important to this thesis as these layouts have a questionable pedagogical underpinning, and their provenance lies in the world of business presentations in which the transfer of information may have a different priority than in education (Gaskins, 2007). The available research does not include data which indicates how many teachers use the readymade PowerPoint templates so vociferously criticised by Tufte (2006), or how many commence with blank slides (as does this author). With the exception of Tufte (2006) and Adams (2006), the use of templates among lecturers is not mentioned in the literature. This is an area that warrants further investigation and is addressed in the Lecturers main study in Chapter 10.

Apperson et al. (2006) researched the effectiveness of PowerPoint compared with written OHTs, and provided each of their lecturers in the PowerPoint group with a scanner so they could, '*scan images (photographs, charts, graphs) ...to enhance their PowerPoint presentations*' (Apperson et al., 2006, p. 121). Surprisingly, the

researchers did not record whether, in the event, any of the lecturers from the PowerPoint group used the scanner or included photographs or charts. Other researchers have remained similarly silent with regard to what was actually depicted in the visual aids used; Koeber (2005, p. 288) recorded only that their content was '*mostly text*'. In some comparative studies, for example Ricer et al. (2005), video and sound were included in the PowerPoint version which were necessarily absent in the OHT variant, and such studies thus contain significant modality differences which may have skewed the findings.

Since the 19th century the term 'illustrated lecture' has been used to describe lectures which contain some form of visual element in support of the lecturer (Green, 1994), and the moniker 'illustrated' offers the prospective attendee the provision of a visual element in addition to the spoken delivery. Although students do not usually pay to attend lectures (or at least, do not do so directly), the use of PowerPoint as a visual aid has been linked to attendance (Koeber, 2005). This aspect of student appreciation might also be likened to one of Levin's (1981) functions of pictures in prose, 'Remuneration' (See Table 10.1); in which one function of images is to increase the sale of a book. In this analogy, the use of visual aids perceived as helpful might impact upon student attendance at lectures. However, the link is not clear; Grabe (2005) found some students used online notes as a replacement for lectures, although Frey & Birnbaum (2002) did not find this to be the case, as their students made use of both opportunities (they concede this finding may have been a result of students saying what they believed the researchers wanted to hear). The influence of visual aids on attendance remains unclear, and is additionally uncertain because of a lack of reported detail on PowerPoint content.

3.4 Ubiquity of text-based visual aids

In the latter part of the 20th century, photocopiers were developed which could copy the content of printed paper onto acetate sheets for overhead projection. This facilitated the creation of overhead transparencies which contained large text which could easily be read when projected onto a screen, and this may have contributed to the contemporary practice of displaying text as a visual aid. Thus, in the 10-20 years prior to the introduction of digital presentation software, the stage was perhaps already set for the introduction of digital multi-slide text displays.

Despite its ubiquity in the 21st century, the provision of text to support a lecture does not meet with widespread acclaim. Young (2004, p. 30) records students' descriptions of professors who '*dump their notes into PowerPoint presentations and then read them*'. Burke et al. (2009) similarly note student complaints about lecturers who read aloud from text-heavy slides, a situation which Yilmazel-Sahin (2009, p. 363) refers to as '*PowerPoint overload*', particularly in undergraduate lectures where the ratio of information to discussion tends to be higher than for postgraduates. However, such comments do not denigrate the use of text-based visual aids per se. Text summaries of key lecture points are perceived by students as helpful, and allow them to listen instead of writing, and are useful for later revision for examinations. When PowerPoint is used this way, lecturers provide what Parker (2001) refers to as a 'triple delivery', in which the same language is delivered to the learners three times; on paper, on screen, and verbally. Parker's (2001) advice is to create separate versions of slide sets adapted for the differing requirements of pre-learning, note-taking, and on-screen visual aids, and thus avoid the presentation of redundant material. Where researchers have adopted such a differential approach, an improvement in student achievement has been recorded (see for example, Levasseur & Kanan Sawyer, 2006; Lowry, 1999), although this approach is not commonly reported in the literature.

The provision of text with temporal pauses may allow a student more time in which to elicit meaning, particularly if a lecture is not delivered in a student's first language. This function has been named the 'Reverse Redundancy Effect' (Toh, Munassar, & Yahaya, 2010), although its function is specific to students learning in a second language, and its use in this setting might arguably be more accurately described as a 'translation aid' than a visual aid. Such bimodal displays may be found at large contemporary conferences, in which the speaker's visual aids are displayed on the main auditorium screen, and a simultaneous transcription of their words is shown on a secondary screen.

When text is arranged in such a way as to show connections between concepts, for example as 'graphic organisers' (Vekiri, 2002), in which relationships are graphically displayed, or as labelling on a diagram, the visual element has a clear supporting role in aiding understanding and retention. But its function when used as redundant iteration of language is unclear; Creed (2001) has linked the display of text-based

slides to the 'Better Mousetrap Illusion', in that the practice allows lecturers to pack more content into their lectures whilst giving an illusion of improvement.

3.5 Lecturers' knowledge and skills

The findings in section 3.4 above raise questions with regard to teachers' and lecturers' abilities in the field of visual aid creation and use. Parks (1999) referred to his own PowerPoint presentations as 'bloated', and admitted he found it hard to throw away slides on which he had spent significant preparation time; his time investment was apparently a stronger influence than the learning needs of his students. Bartsch & Cobern (2003) found their lecturers required 50% more time to create what they called 'expanded PowerPoint', which contained text and pictures, sounds, text which appeared in 'different ways', and graphs or tables. The description provided for the images was that they related to the lecture 'in some way', and Bartsch & Cobern's (2003) report represents a further example of research in which the nature of the content is apparently not considered sufficiently important to warrant description. As the 'expanded' PowerPoint required only 50% more time to create than text alone, one might surmise the amount of time expended on pedagogical functionality to have been limited. In 1997 the Dearing Report suggested three hours preparation should be allocated to create a one hour HE lecture (Chiddick, Laurillard, Quigley, & Wolf, 1997); if visual aids are required for such a lecture, and thinking time is also necessary, this estimate realistically allows sufficient time only to type simple text or to insert images which are readily available. Further research is required in this area, to establish whether, for example, lecturers would create more pedagogically functional visual aids if they were allocated additional preparation time and resources. This question is discussed further in Chapter 11.

Slykhuis et al. (2005) carried out eye tracking experiments in which students viewed PowerPoint slides that contained text and relevant pictures; only some of the images contained information in addition to that included in the text. They found students spent the most time looking at pedagogically purposeful images, although perhaps unsurprisingly they noted students also wasted time looking at elements contained in pictures which were relevant but merely decorative. This supports the findings of Yarbus (1967) who noted gaze to be dependent on the guidance provided by the person who displays the image. Although their study was computer facilitated and

did not include a lecturer, the study of Slykhuis et al. (2005) is notable for its concentration on impact of content rather than modality. In addition to the observation made above that some researchers have assumed a comparison between OHP and PowerPoint to be valid in its own right, it might be noted that Slykhuis et al. (2005) would presumably have recorded similar results if they had used colour acetates and an OHP.

A lack of preparation time may not be the primary reason for the creation of visual aids which comprise text, or the inclusion of images which are only decorative. Messaris (1994) refers to 'Production Literacy' as a component of Visual Literacy, and suggests that although ordinary competence in perceptual skills may allow interpretation of visual representations not previously encountered, this competence does not automatically equip individuals to produce a visual rendition of something which is not contained in their long-term memory. This need not be as far reaching as what Ulmer (2003) refers to as 'electracy', in which there is a connection between digital hyperlinked media and an individual's creative thinking abilities. The question of whether lecturers possess 'production literacy', either innately or as a result of training, warrants further investigation and is discussed further in Chapter 4.

Wright (2009) suggests many presenters would be better to develop their skills as a speaker than spend time using presentation software, and although his point is driven primarily by experiences of ineffective slide content, the development of speaking skills need not exclude the visual modality if one includes imagery stimulated by descriptive speech. The degree to which teachers and lecturers employ descriptive speech in order to concretise and illustrate topics as described in Chapter 2, is an area which warrants further research.

Adams (2006) draws an analogy between lecturers' use of presentation software, and architects' use of architectural design software; she observes the latter encourages the building of many houses of similar appearance, and suggests PowerPoint similarly encourages lecturers to create unimaginative slide shows which follow the default setting and which possess a common appearance. The analogy with architectural software may not hold however, as rows of near-identical terraced houses in British cities were built long before the advent of computers, and as noted by Bloom (1953), some lecturers delivered uninspiring lectures long before the

availability of presentation software. One might turn Adams' (2006) analogy around, and observe that while the identical terraced houses constitute homes, it is unknown how many of the millions of mimetic PowerPoint slides created have actually assisted learning. This question sits at the core of this thesis.

During the late Victorian period, teachers in England were expected to be able to draw and reproduce objects on a blackboard as a fundamental part of an 'object lesson' (Robinson, 2004). Yet Evans, Watson, & Willows (1987) found the provision of illustrations in learning to be low on a list of priorities among a sample of Canadian teachers, and observed,

'when questioned directly about their use of illustrations in teaching, most of the interviewees seemed not to have given the matter much serious thought. Beyond the decorative role served by pictures in classrooms and the motivational/attentional role ascribed to textbook illustrations, it appears that the educational functions of illustrations are rarely articulated by teachers' (Evans et al., 1987, p. 93).

In a US study which involved teacher educators and their undergraduate trainee teachers, Yilmazel-Sahin (2009) recorded descriptions from trainees of slides being read aloud by their lecturers, and of too much information placed on individual slides.

The findings of Yilmazel-Sahin (2009) are important because, in addition to their responsibility for delivering the curriculum for trainee teachers, the participants also model teaching practice, and many studies have found that teachers tend to teach the way they themselves were taught (Carroll & Morrell, 2006; Lortie, 1975).

The use of media in teaching has been linked to a teacher-centred, information-transmission model of teaching (Gow & Kember, 1993; Trigwell & Prosser, 1996), although in common with many of the studies cited in 3.3 above, Gow & Kember (1993) and Trigwell & Prosser (1996) did not specify the content of such media. The use of media by teachers and lecturers need not indicate the employment of an information transmission approach; Norton et al. (2005) note that the use of media to support learning may also be linked to teachers with an orientation toward learning facilitation. However, it is possible that lecturers with a facilitative approach to teaching may nonetheless utilise visual aids which offer only an iterative transmission of information, and the limited descriptions of visual aid content

provided in the literature suggests this may be the case for some lecturers with an otherwise student-centred approach to teaching. Vallance & Towndrow (2007, p. 226) support this notion, and suggest that '*informed use*' of instructional technology is rarely modelled in ITT.

In support of their Learning and Teaching in Higher Education (LTHE) programme for lecturers, the University of Exeter provides a booklet which recommends the display of '*pictures, cartoons, and graphs, when they help to bring your subject to life*' (Race, 2010, p. 8), and this advice is supported by a plea not to '*cause death by bullet point*'. I contacted the course director of the University of Exeter LTHE programme to inquire whether the design and use of visual aids forms a discrete part of the syllabus. She informed me that the topic is included only in as much as it is modelled during the course (D. Fung, personal communication, September 30, 2011).

I have been unable to find a report in the literature of an investigation which examines the visual aid practice of teacher educators based in the UK, although personal experience (as both a trainee and lecturer in teacher education) suggest an inquiry may be warranted in this country. This question is addressed in the Lecturers main study reported in Chapter 10 of this thesis.

Many teachers and lecturers, particularly in HE, teach to learning outcomes which are relatively abstract in their nature and which cannot be represented in the same way as, for example, a chemistry lecturer might illustrate the nature of a compound by the display of a molecular model. However, the literature does not describe what learning outcomes lecturers aimed to achieve with their visual aids; either in terms of specific slides or of the whole lecture. The literature also offers little data with regard to the knowledge and proficiency of the lecturers who participated.

Although research which inquires into the visual support of business presentations is perhaps not directly transferable to an educational environment, it is nonetheless relevant to this thesis. Two studies are regularly cited in the business arena, even though they were undertaken before the availability of digitally produced visual aids. These are the so-called '*Wharton Study*' of 1981 (Befus, 2005) and the '*3M Study*' of 1986 (Vogel, Dickson, & Lehman, 1986). A key finding of the Wharton study was that,

'groups in which one of the presenters used overhead transparencies were more likely to reach consensus than groups where none were employed' (Befus, 2005).

Befus (2005) notes the results were not statistically significant but were nonetheless used to aggressively sell presentation equipment. The later '3M Study' (Vogel et al., 1986) compared OHTs which contained only text with others which comprised text supported by simple cartoon graphics. For example, the words 'Working smarter not harder' appeared in the graphics version alongside a cartoon figure of a person with a light bulb beside their head. A key finding of the 3M Study was that *'presentations using visual support were 43% more effective'* (Vogel et al., 1986, p. 8). This conclusion appears to have gone largely unquestioned, despite scant detail contained in the research report concerning the nature of the content credited with producing such a gain.

Vogel followed the 3M study with a doctoral thesis (Vogel, 1986) in which he compared variations in OHTs designed with a computer programme. The designs compared were: black and white images against colour images; text against image-enhanced text, and OHTs against 35mm slides. He measured 'persuasive effect' and aimed to develop a theory of *'attention and yielding'* (Vogel, 1986, p. 13), in which 'yielding' represented a measurable compulsion to buy a product on the part of the participants who attended the presentation. 'Yielding' is a term unlikely to find acceptance among teachers and lecturers, and this may account for citations of this study being predominately limited to business presentation literature. Nonetheless Vogel's (1986) study provided interesting results, in that attendees' perceptions appeared to have been enhanced by colour, and also by the use of OHTs when compared with 35mm slides (at that time OHTs were the more modern technology). This result was echoed in the late 1990s by students' reported higher rating of lectures supported by PowerPoint (see for example, Koeber, 2005; Susskind, 2005). Unlike many visual aid studies which followed, Vogel (1986) provided details of the slide content and included copies in appendices, and these indicate he employed a mixture of redundant cartoons (such as dollar bills to represent a fiscal total), pie charts, line graphs, and spider diagrams. Vogel's (1986) results do not distinguish between cartoons and charts, and measured only their cumulative effect combined in a single presentation.

Vogel's (1986) research design is of particular relevance to this thesis because his study investigated the impact of slide content. As with educational researchers, most business-oriented researchers who have investigated presentations have concentrated on modality rather than content. For example, Griffin (1994) surveyed business presenters, and asked whether respondents 'used visuals' and 'which medium is most often used', but he provided little information about the design of that which was displayed, or how it related to the topic at hand. However, In a contemporary study, Guadagno, Sundie, Hardison, & Cialdini (2011) pursued Vogel's (1986) investigation into the capacity of the content of visual aids to persuade. Their research investigated the impact of an animated PowerPoint bar chart on a group of subject experts and non-experts. The researchers found that inexperienced participants were more easily swayed by sophisticated chart-based graphics than those who knew the subject well. Although the findings of Guadagno et al. (2011) are clearly of interest to the advertising industry, at which the research is aimed; in the context of education this would presumably represent an effect to be wary of, rather than to utilise.

One contemporary study has particular relevance to this thesis; Kosslyn, Kievit, Russell, & Shephard (2012) investigated a range of PowerPoint presentations for quality matched against set definitions. Kosslyn et al. (2012) undertook their research from three standpoints; a sample of online presentations were judged for 'violations of psychological principles' (Experiment 1); reports from regular attenders of PowerPoint and Keynote presentations of experiences which contain similar 'violations' (Experiment 2), and a test in which participants were presented with pairs of 'do/don't' examples of slides (with the relevant indicators omitted), and invited to select the 'correct' version in each pair (Experiment 3). As a basis for judgement the paper employed a series of 8 'principles' and 139 'rules', which the authors explain emanate from '*Clear and to the Point: Eight Psychological Principles for Compelling PowerPoint Presentations*' (Kosslyn, 2007a). In the introduction to this volume, Kosslyn accedes the book is not presented as an academic argument, and that the principles contained therein are derived from an earlier volume concerning the presentation of graphs and charts (Kosslyn, 2006). In Experiment 1, 141 PowerPoint slideshows were selected from the Internet and judged for 'violations' of the 8 principles, many of which relate directly to the way in which text is displayed. In so

doing, the researchers grant a degree of validity to the selected presentations which may not be justified, as Internet-published slides are often required to be comprehensible without a presenter or narration. The researchers found the three most commonly violated rules to be related to the way in which bullet pointed text was displayed. Interestingly, they did not comment on the validity of publishing a presentation without an original narration.

In making judgements of slide sets published on the Internet without knowledge of their provenance or original learning outcomes, Kosslyn et al. (2012) effectively validate the display of text regardless of pedagogical purpose; by an implicit assumption that a slide set should be comprehensible on its own. Text-heavy slides which may be frustrating for students if read aloud during a lecture (Mann & Robinson, 2009) may be appropriate when used as an online lecture summary; conversely, brief text, or an image or model displayed during a lecture may be meaningless if unaccompanied by an explanation. If, for example, the slides of Gore's (2006) award winning climate change presentation '*An Inconvenient Truth*' (Guggenheim, 2006) were to be published online unaccompanied by any narration, some slides would be not be comprehensible, and might appear to violate some of the principles applied by Kosslyn et al. (2012). Thus Experiment 1 (Kosslyn et al., 2012), which found not one single slideshow of the 141 examined to be free of flaws, may be based on a questionable premise.

Experiment 2 (Kosslyn et al., 2012) has a more direct relevance to this thesis; this investigation employed an online survey to ask participants about recent experiences of presentations they had attended, and paid specific attention to the nature of the slides shown. The researchers found the most common complaints to be that speakers read aloud from slides, and that the slides contained too much detail to be absorbed before the next slide was presented; which accords with complaints recorded from HE students reported earlier in this chapter (Burke et al., 2009; Young, 2004). Of particular interest is that, notwithstanding the reservations noted above regarding online presentations; in Experiment 1, Kosslyn et al. (2012) compared presentations across different professions; academic researchers, education, government and business, and in Experiment 2, the researchers recruited respondents who were engineers, financial experts, business managers and students. Kosslyn et al. (2012) found visual aids used in education to be no better,

or worse than those used in presentations from other professions; this finding supports a notion emergent in this literature review that PowerPoint and Keynote presentations in these diverse areas may have a design base which is not always founded in pedagogy.

A study carried out by Simon (2013) is also relevant to this thesis because she investigated online slide content without narration (although it was not peer-reviewed and published only online). 48 hour retention for text-only slides was compared with retention for slides which contained brief text accompanied by images. The text and image slides comprised brightly coloured graphics which were relevant, but did not add information to the text. Perhaps unsurprisingly, Simon (2013) found that when questioned 48 hours later, respondents recalled the brightly coloured slides more clearly than text-only slides. However, participants did not recall any more facts than those who had seen the text-only variant. This survey was designed for display on Simon's (2013) company website rather than publication in a journal, and may be easily accessed by those who seek guidance on visual aid design from an Internet search. Paradoxically, Simon's (2013) study reinforces the finding of Mayer & Gallini (1990) that images which are merely relevant but which contain no additional information do not aid recall (except perhaps of the images themselves), whilst Simon (2013) herself claims that images aid recall of slides. These claims are not necessarily counter to each other, as Mayer & Gallini (1990) evaluated recall of material to be learned, while Simon (2013) limited evaluation to recall of the slide appearance.

Colourful, professionally created presentations do not often feature in the literature, or if so, are not identified as such. Yet Tangen et al. (2011) suggest that for students who receive a lecture from a *'tech-savvy academic, the experience is not unlike an educational Pixar film'* (Tangen et al., 2011, p. 871). Although this somewhat optimistic description may not match the experiences reported by some undergraduate students (Mann & Robinson, 2009); given sufficient resources and expertise, it is nonetheless possible for high-quality presentations to be created. For example; Gore's lecture *An Inconvenient Truth* (Guggenheim, 2006) mentioned above has received much critical acclaim. A recording of Gore's climate change lecture won an Academy Award in 2007, a 'Grammy' in 2009 and contributed directly to Gore's joint award of a Nobel Peace Prize in 2007 (Matson, 2009). Although it

lasts for 93 minutes, the lecture contains only eleven text-based slides, of which only one of these includes bullet-points. However, exemplar lectures such as these are not commonly seen outside of large conferences, and for many, the continued portrayal of what Kress & Van Leeuwen (2006) call 'the old visual literacy', (namely text) may prevail.

Clearly the resources of most lecturers would not stretch to creation of a lecture of the standard of *An Inconvenient Truth* (Guggenheim, 2006), but one might question how many teachers and lecturers possess sufficient production literacy (Messaris, 1994) to design a lecture in which each element of visual support possesses a pedagogical purpose, and in which the experience might be likened to a 'Pixar film'. It is perhaps ironic, that an image projection device conceived in the mid17th century, and which so astonished audiences of the period that it earned the moniker '*The Lantern of Fear*' (Mannoni, 2000, p. 48), should, after three and a half centuries of development, be responsible for visual displays which are sometimes known as '*Death by PowerPoint*' (Garber, 2001).

3.6 Lecturer effect: Gesture and expression

The effect of a lecturer's physical movements, gestures and expression may impact upon students' interpretation and absorption of visual aids. Tversky (2010) has described human communication as a '*sound and light show combining words, prosody, facial expressions, gestures, and actions*' (Tversky, 2010, p. 499), and depending on the enthusiasm of the lecturer, their actions may create a strong draw on visual cognition. For example the deictic gesture of pointing (Kendon, 2004) is not limited to a single hand; a lecturer may effectively point by simply looking towards a screen or by inclining his/her head toward it. The effect of a speaker producing a complementary action on the part of a listener is known as 'joint attention' (Eilan, 2005; Heal, 2005) and may have a significant impact on student attention during a lecture. Although this element is necessarily absent in research which utilises narration and images displayed on a computer screen, of concern to this thesis is the finding that such data is also absent from most of the literature outlined in this chapter; with the notable exceptions of Naftulin et al. (1973) and Carpenter et al. (2013), in which the lecturers' mannerisms were a key focus of the research.

If a lecturer does not interact with a visual image in any way, it may result in relevant constituent parts being missed by students. Weidenman (1989) noted that if learners are not given instructions or guidance with regard to what to look for in a picture, they are likely not to make full use of the image and to miss information due to treating it as a decorative function. Tabachneck-Schijf & Simon (1996) stress the importance of cueing (also known as 'signposting' (Exley & Dennick, 2009)) to assist learners in the assimilation of information from images, and Thompson, Driscoll, & Markson (1998) note that adults learn and remember more when gestures and visual cues are used in teaching.

Tabachneck-Schijf & Simon (1996) suggest that unless a depiction is of a kind known to learners, they may pick up cues which are of interest, but which are not relevant to the purpose, as found by Slykhuis et al. (2005). Lin & Atkinson (2011) reinforce the importance of cueing in the context of saving a learner's time when confronted with a complex visual, and Bull (1990) suggests the gestures of a lecturer pick out significant features of their message by the addition of vocal stresses and syntax, as well as provision of information to learners about the speaker's level of commitment. Pozzer-Ardenghi & Roth (2005) suggest gestures are critically important to link photographs with text, and help learners by decreasing ambiguity in images displayed during lectures. Lecturers' deployment of such gestures is not recorded in the research literature, and this additional aspect of visual aid use might usefully be included in future inquiries into the use of this medium.

3.7 Discussion

Display equipment which can '*make the picture of any thing appear on a wall*' (Hooke, 1668, p. 741) has been available since the invention of the magic lantern over 300 years ago, and in recent decades the genre has been developed to create and display sophisticated digital imagery. In the light of such creative potential, it is perhaps surprising that most researchers cited in this chapter chose to compare media (chiefly OHP and PowerPoint) with little mention of either the content of the displays or their relationship to learning outcomes. A reason may be that for some of the studies, the slides comprised text summaries only, and researchers may have considered the designs to have been insufficiently varied to warrant discussion. That text may be the content of choice is suggested by reports of lecturers reading aloud from slides (Burke et al., 2009; Young, 2004), some references to text content

(Koeber, 2005; Susskind, 2005), and an implicit assumption that slide sets should be comprehensible when published online without a narrative (Kosslyn et al., 2012). If the slide sets compared in the above studies did contain similar textual content, it is perhaps unsurprising that some researchers recorded no difference in student achievement between those who experienced OHP and those whose lectures were supported by PowerPoint (Bartsch & Cobern, 2003; Savoy et al., 2009; Szabo & Hastings, 2000).

The notion that teachers and lecturers may sometimes simply follow the choices offered by PowerPoint's template settings (Adams, 2006), and the findings of Kosslyn et al. (2012) that differences in design between slide shows used in education and those used in the commercial world may be minimal, further suggest that visual text-summaries may be the de facto choice for teachers of post-16 learners. Although there may be nothing inherently educationally unsound in the display of text, the use of this medium has been linked with student disaffection (Burke et al., 2009; Mann & Robinson, 2009; Young, 2004) and this modality warrants further investigation in a lecture setting.

Another factor which may have impacted upon many researchers' decision not to include the nature of content in media comparisons may be their own levels of visual understanding; their own visual literacy. The prevalence of such literacy and an associated ability to communicate through the visual medium is discussed in the following chapter.

3.8 Conclusion

This chapter has identified that much of the research literature which relates to visual aid use in post-compulsory education has compared modalities but has not included detail which describes content. A gap in the literature thus exists regarding the purpose, design and efficacy of visual aids in classroom and lecture-based learning. The chapter also identified a gap in the literature with regard to the tuition received by teachers and lecturers in the use of visual aids. This chapter has identified that some students are dissatisfied with the way in which visual aids are employed in their lectures and that this may be connected with text summaries presented concurrently with speech. It has found that once requirements for lecture preparation and revision notes are excluded, evidence which supports the display of

text summaries is not clearly discernible and the employment of such displays thus warrants further research in the setting of a live lesson or lecture.

The following chapter examines the influences which may have impacted upon teachers' and lecturers' visual aid practice.

Chapter 4 What cultural influences might impact upon lecturers' practice?

4.1 Introduction

In the mid-19th century, educational writers extolled the benefits of a blackboard situated in a classroom, but none provided instruction or examples of how to use the medium (Bumstead, 1841). 170 years later, Chapter 2 of this thesis has identified that a scarcity of readily available information still exists with regard to how to design and integrate visual aids in lectures. This chapter investigates why knowledge which relates to the use of the visual medium is not more widely disseminated; why the visual modality may play a limited role in post-compulsory education, and why it may not be routinely included in ITT curricula.

4.2 Images and language: A chequered relationship

Despite the existence of images as a means of sharing depictions of scenes and objects among humans over many thousands of years, their role as a serious or educated mode of communication has been argued over for centuries (Mitchell, 1986). A historical disdain for images compared with language is briefly summarised below; its significance to this thesis is that such attitudes may have brought about a reluctance to use images in an educational setting.

Notwithstanding the benign comparison of words and images implicit in Horace's 'Ut pictura poesis' (as is painting, so is poetry) (Rudd, 1989), a debate that has been called the 'word and image divide' has been prevalent since pre-renaissance times (Elliott, 2003). In *Della Pittura*, Da Vinci actively challenged centuries of tradition that maintained painting's inferiority to poetry (Lipert, 2005). Da Vinci believed the description of physical forms without the use of illustration would have a negative effect on the perception of the listener,

'You who wish to represent the form of man... relinquish that idea. For the more minutely you describe the more you will confine the mind of the reader, and the more you will keep him from the knowledge of the thing described. And so it is necessary to draw and to describe'. (Lester, 1999, p. 207)

Mitchell (1986) suggests the history of culture has been, in part, 'a *struggle for dominance between pictorial and linguistic signs*' (Mitchell, 1986, p. 43), and in the late 19th century, the contest appeared to have been won by the latter. The

prevalence of illustrations in Victorian adult literature by authors such as Charles Dickens was frequently criticised; for example the London Times suggested Dickens' written elucidations were so effective that illustrations were unnecessary (Cohen, 1980). A disdain for images extended to the devices that replicated them; the magic lantern is the antecedent of contemporary projection devices in lecture theatres the world over, yet in the 18th and 19th century it was often regarded as offering entertainment suitable only for '*children and common people*' (Mannoni, 2000, p. 84).

Goethe recognised the impact of images, and suggested they possessed a '*magic power*', although he believed they produced a negative effect; he wrote, '*as our sense it rivets and ties, the mind is held in chains*' (Gombrich, 1978, p. 139).

Wordsworth believed the use of images signalled a '*backward movement...to childhood*' (Hutchinson, 1964, p. 489), and disdain for images in the late 19th century became so widespread that authors who had previously included illustrations in their works, such as Thomas Hardy, began to exclude them (Cohen, 1980).

Descriptive speech also has a long lineage; the ability to vividly describe the form and essence of an object known as 'ekphrasis' was valued by Greeks and taught as part of rhetorical training. This skill prevailed for many centuries; Tennyson wrote in such a visually descriptive style that his poem the *Lady of Shalott* was likened to the experience of viewing through a stereoscope (Armstrong, 2007). Yet by the early twentieth century, a disdain for imagery had spread to descriptive writing; in 1937 W.B. Yeats recorded how he had spent his life '*clearing out of poetry every phrase written for the eye, and bringing back to syntax that is for ear alone*' (Meisel, 1983, p. 433).

A stereotypical view of images as primarily suited to unthinking people was perpetuated by Virginia Woolf who suggested that for cinema audiences '*their eyes lick up the screen while their brains lie dormant*' (Woolf, 1966, p. 98). Such disparagement of images provided as an accompaniment to language continued into the twenty first century; illustrated or picture books are often linked with primary education, with '*children dictating at what age they graduate to non-illustrated material*' (Foreman, 2011). Kress & Van Leeuwen (1996) observe that visual communication is not valued as a form of expression for '*articulate, reasoned expression*,' and is '*often seen as a 'childish stage' one grows out of*' (Kress & van

Leeuwen, 1996, p. 16). Such attitudes may discourage those who might otherwise develop their own visual communication skills; Cohn (2012) notes that we consider it normal for people not to learn to draw, and judge those who are able to do so to be exceptional. Bland (2009) comments on a drive to increase visual literacy in Australia, and suggests a primary function of increasing visual literacy is to help marginalised young people. Yet such a justification may reinforce a notion of images as suitable for less academically able learners. In view of the above comments, one might observe a paradox, in that the 'Picture Superiority Effect' (Paivio & Csapo, 1973) described in Chapter 2 has been shown to increase in effectiveness with age from middle childhood to adolescence (Whitehouse, Maybery, & Durkin, 2006), and to be greater in older adults than younger adults (Ally et al., 2008).

That such attitudes exist with regard to adult education is illustrated by Goldsmith (1987). He records that in the United Kingdom adult literacy campaign which ran during the 1970s, publishers were reluctant to produce illustrated texts because it was felt that '*adults might find it embarrassing to be seen in public with an illustrated reading book*' (Goldsmith, 1987, p. 53). Such a separation of images from educational material is maintained today; Kress & Van Leeuwen (1996) note that by the time children have reached the age of thirteen, illustrations have largely disappeared from their books as well as from their own writing. Dimopoulos, Koulaidis, & Sklaveniti (2003) identified such a transition in school science textbooks. They recorded a reduction in the proportion of images over three years; from 20 illustrations per 1000 words in upper primary school, to 1.2 per 1000 words in lower secondary school (Dimopoulos et al., 2003).

Elkins (2008) observes a paradox in that books which take a conceptual or philosophical view of visual literacy often contain no illustrations. Academic reports which describe investigations which involve images are not immune to such an observation; for example, Clatworthy, Simon, & Tiedeman (1999) conducted research into the relationship between children's drawings in hospital and their emotional states. One might expect such an article to include examples of the drawings which form the basis for the study, yet their report includes no sample of such a drawing to facilitate appreciation of their findings. Similarly, Riding & Douglas (1993) compared subjects' learning from computer presentations which comprised either text-plus-picture or text-plus-text, yet they provided no example in the research

report by which the reader might judge for themselves the researchers' claim of informational equivalence for the text and pictures used.

A historical disdain for images which has often held the modality to be unworthy of a mature and educated mind is particularly relevant to this thesis, because it is possible this attitude has influenced the contemporary use of images in education, and may also affect any attempt to influence the situation. It is possible that a high regard for text is also a contributory factor to the widespread use of this modality in post-compulsory education. The next section considers the concept of visual literacy as it relates to society.

4.3 Visual literacy in society

The degree to which the population at large is visually literate may be interconnected with the expectations of adult learners and their teachers. The term 'Visual Literacy' is generally attributed to Debes (1969) who described it as an attribute which comprises,

'A group of vision competencies. Through the creative use of these competencies, he is able to communicate with others'

(Debes, 1969, p. 27).

The act of communicating with others by visual means sits at the core of this thesis. Heinich, Molenda, Russell & Smaldino (2002) have refined the definition of visual literacy further as,

'The learned ability to interpret visual methods accurately, and to create such messages' (Heinich et al., 2002, p. 113).

Most writers agree visual literacy is a learned ability (Messaris & Moriarty, 2011), and implicit in this notion is that the ability of an individual to communicate by visual means may be impaired if no tuition has been received. The question of lecturers' ability to create visual methods to communicate is central to this thesis, and it is interesting to note that some writers place creative ability last when defining visual literacy. For example, Shifrin (2008, p. 106) describes visual literacy as that which enables a literate student to *'access, analyze, evaluate and communicate messages in a wide variety of forms'*. The positioning of the skill of communication at the end of such a list is perhaps intuitively logical; one might reasonably expect that perceptual skills be acquired before attempting to communicate, just as one needs to be able to

read before developing the ability to write. Yet in Australia, a drive to increase visual literacy in schools has produced a definition in which the element of creation appears first. In a government sponsored report, Davis (2008) defines visual literacy as,

‘The ability to create, process, critique and appreciate the spectrum of visual phenomena in the individual’s external and internal environment.’

(Davis, 2008, p. 11)

The American Association of Colleges and Research Libraries (ACRL) Visual Literacy Competency Standards for Higher Education provide the following learning outcomes for proficiency:

- a. Creates images and visual media to represent and communicate concepts, narratives, and arguments (e.g., concept maps, presentations, storyboards, posters)*
- b. Constructs accurate and appropriate graphic representations of data and information (e.g., charts, maps, graphs, models)*
- c. Produces images and visual media for a defined audience*
- d. Aligns visual content with the overall purpose of project*

(Hattwig, Burgess, Bussert, & Medaille, 2011)

As with Davis (2008) above, it is interesting to note that Hattwig et al. (2011) place the creative element first. These standards were written for students, yet implicit in such descriptors is the notion that their lecturers should also be able to achieve such outcomes; as Eilam (2012) observes, teachers who are ‘naïve’ with regard to visual aids are likely to miss opportunities to develop visual literacy in their students.

The placement of creative ability at the start of a list of competencies appears at odds with the writing analogy provided above, yet this may not be an accurate analogy; a more apposite comparison might be made with the creation of images in early childhood. Such creative ability is often allowed to wither, and Kress & Van Leeuwen (1996) observe that children’s grammar is corrected in education, while their illustrations are not. Additionally, by the time children are past their first two years of secondary education, illustrations are largely absent from their school work (Kress & van Leeuwen, 2006).

Thus it is possible that in addition to the historical influences described in the preceding section, a further influence upon the use of images in post-compulsory

learning may be an undervaluation of image creation experienced during the early years of education. Sless (1981) observed that as children we establish an early link between text and pictures in the first books we read. As we grow older, we are expected to develop literary skills with words alone, resulting in a contrast between the importance of written material and a relative unimportance of pictures. He postulates that words are associated with thinking and pictures with seeing, and suggests reading is seen as '*an intellectual activity*' and looking at pictures a '*matter of picking up information which is there*' (Sless, 1981, p. 74).

In the 1980s Harthan (1981) questioned whether '*in a coming age of computers and silicon chips...illustrations will survive*' (Harthan, 1981, p. 281). That illustrations have survived is evident from the rows of colourfully illustrated magazines offered in high street newsagents, and also in the publication and ready availability of images on the Internet. Yet a ubiquity of images does not in itself indicate widespread visual literacy, and the proliferation of media images has been described as an '*ever burgeoning tsunami of visual junk*' (Davis, 2008, p. 116). The American Libraries Association Competency Standards for HE (Hattwig et al., 2011) states '*the visually literate student finds and accesses needed images and visual media effectively and efficiently*', and an assumption that suitable images may be 'found' rather than created may indicate a limitation to their aspirations for visual literacy.

In contrast to the triumvirate of visuacy, literacy and numeracy sought for Australian education (Davis, 2008), Chapters 2 and 3 of this thesis suggest a triumvirate of literacy and numeracy may prevail in UK post-compulsory education. Stafford (1997, p. 1) argues that a '*long-standing cultural distrust of vision*' (Stafford, 1997, p. 1) has left society unequipped to understand, or benefit from visual modes of representation, and Kress & Van Leeuwen (2006) believe a move to change this situation may not be welcome, they suggest,

'a move towards a new literacy based on images and visual design, can come to be seen as a threat, a sign of a decline of culture, and hence a potentially potent symbol and rallying point for conservative and ever reactionary social groupings' (Kress & van Leeuwen, 2006, p. 17).

A small number of countries outside Britain have attempted to introduce changes designed to increase visual literacy within their population, starting with children in

full-time education. The neologism 'Visuacy' has entered the lexicon as an amalgamation of 'visual' and 'literacy' (Avgerinou & Pettersson, 2011) and is employed in a proposal for the introduction of visual literacy into the Australian curriculum (Davis, 2008).

The next section considers the degree to which lecturers and teachers are visually literate with regard to the visual aids they use in class and lecture rooms.

4.4 Visual literacy among teachers and lecturers

Langer (1957) believed that *'Visual forms are just as capable of articulation, i.e. of complex combination, as words'* (Langer, 1957, p. 93), and while this may be so in theory, in practice such articulation may be difficult to achieve. Teachers and lecturers are able to produce articulate language in the form of speech at will, and with the aid of suitable materials can do the same with written language. Yet it is not clear how many are able to communicate with images. When cave paintings were first discovered at Lascaux, crayons were found on the floor which are believed to have been in situ since placed there by the creators of the images some 16,000 years previously (Bahn & Vertut, 2001). One might question how many teachers and lecturers (aside from those engaged in the visual arts) presented with such a scenario would be sufficiently visually literate in a creative sense to pick up a crayon and draw a meaningful image as adroitly as they could compose a sentence.

An evolutionary contrast between the use of images in entertainment and their application in post-compulsory education is illustrated in Figure 4.1. I have chosen as a starting point the introduction of the 'magic lantern' because it represents two milestones in the history of visual aids. Firstly, 1667 was the first time images could be produced at will for groups of people, and adjusted for size and location, and secondly, its use as a visual aid in education is first recorded at the end of the 18th century (Mannoni, 2000). As may be seen from Figure 4.1, a diversion from technological advancement toward a relatively bland display of text occurred in adult education around the introduction of the overhead projector. As discussed in Chapter 3, the combined availability of OHPs, dot-matrix printers, and acetates printed from photocopiers, allowed anyone who could print a text onto paper to also copy the content onto acetate for projection. Overhead projectors were not sufficiently powerful to be used in large auditoriums, and 35mm text slides were

created for these environments by means of the ‘*Diazo*’ chemical process (Kueter & Miller, 1981) for use with long-throw slide projectors. In this way, 35mm slide film, which was capable of recording high quality images, was instead used to display two-colour text. The ubiquity of these modalities in lectures and conferences may have contributed to a general acceptance of text as the de facto choice for visual support. Since that time the advent of personal computers and tablet devices has

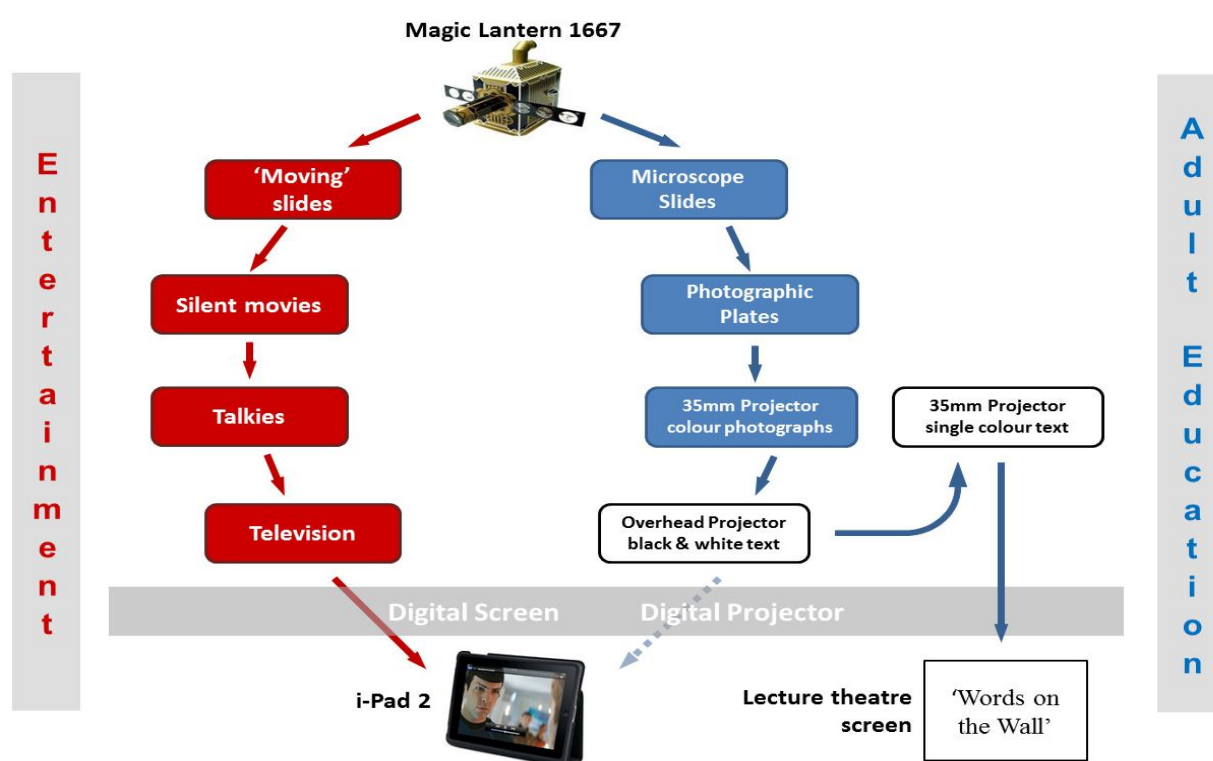


Figure 4.1 Comparison of development of projection in entertainment and education.

provided the facility to create and adapt an almost infinite variety of images. However, a lack of import attached to visual literacy, coupled with a normalising effect resulting from the widespread use of text-based visual aids may have contributed to the ubiquity of this method today.

However, not all commentators accept the status quo; Stafford (1997) notes,

‘It is extraordinary that schools, colleges, and universities have not made it a top priority to train every student in the cognitive, affective and expressive potential of imagery’. (Stafford, 1997, p. 6)

The film director George Lucas suggests students should be able to understand a ‘new language of expression’. He notes,

'We live and work in a visually sophisticated world, so we must be sophisticated in using all the forms of communication, not just the written word...when this understanding doesn't make its way into the classroom ...you see very educated people, doctors and lawyers and engineers, trying to make presentations, and they have no clue about how to communicate visually.' (Daly, 2004, p. 3).

Lucas' inclusion of engineers in a list of professionals who experience difficulty in communication by visual means resonates with Tufte's (2003) criticism of NASA engineers' attempt to visually articulate priorities in the Challenger space shuttle crisis described in Chapter 2. Additionally, the findings of Chapter 2 suggest one might add 'some teachers' and lecturers' to Lucas' list of professionals. The director Martin Scorsese also espouses the view that adults should be visually literate,

'There are certain tools that you use, and those tools become part of a vocabulary. And it is just as valid as the vocabulary that is used in literature, in our language' (Cruickshank, 2006).

In addition to the cinema industry, the advertising world values visual production literacy, albeit for commercial purposes; see for example Forceville's writing on pictorial metaphors in advertising (Forceville, 2008) and Huhmann's treatise on the use of visual rhetoric in this medium (Huhmann, 2008). However, comparisons with the advertising industry may not be palatable to teachers and lecturers.

This thesis does not seek to denigrate presentation software per se; for example Gore's *An Inconvenient Truth* (Guggenheim, 2006) was created in Apple Keynote, yet the influence of such software cannot be ignored. As noted above, the ease with which text-based visual aids could be produced on acetates and 35mm slides may have influenced the frequency with which text was displayed, and coupled with a widespread belief that presentation of a redundant stimulus assists learning (Sweller, 2005), the emerging digital technologies made such a process even easier to produce. The next section examines the impact of ITT on visual aid use among teachers and lecturers.

4.5 Initial Teacher Training

Messaris (1994) identifies 'production literacy' as an important element of visual literacy. He suggests that while some adults may have competence in perceptual

skills which allow them to interpret visual representations, they do not necessarily possess the ability to design or create them. The notion that this situation may prevail among some teachers and lecturers is supported by a small number of studies undertaken outside of the UK. For example, in Canada, Roth, McGinn, & Bowen (1998) found eighth grade school children outperformed trainee teachers in the design visual representations of scientific concepts. In a study of undergraduate trainee teachers in Spain, Pena & Quilez (2001) found trainee teachers to have difficulty expressing themselves visually, and in Israel, Miller & Eilam (2008) found trainee teachers were less competent in the creation of diagrams than school children. Such training as is provided often concentrates on the operation of equipment and software rather than the design and function of visual aids (Griffin, 1994).

The observations outlined above with regard to trainee teachers provide cause for concern. However, Vallance & Towndrow (2007) note that teachers tend to teach in the way that they were taught themselves, and Konigs et al. (2007) found that teachers tend to absorb new developments in accordance with their own practice; observations which may offer an explanation as to why some researchers record the transfer of acetate visual aids to PowerPoint without changing the design of the display (see for example, Koeber, 2005; Susskind, 2005).

Bleed (2005) suggests it is important to embed visual literacy into the early stages of teacher education programmes. He suggests there is a dichotomy between '*faculty, stuck in yesterday's analog world*', and '*students who arrive nicely fluent in digital technology*' (Bleed, 2005, p. 6). This accords with Prensky's (2001) dichotomy of 'Digital Natives' and 'Digital Immigrants', although even if students are more familiar with the access of image-rich digital media than some of their older tutors, it is not clear that they are necessarily any more visually literate in the production of purposeful images.

A National Education Association study undertaken in the US in 1923 inquired into the availability of tuition for teachers in visual education, and found over twenty institutions which offered such courses (Babbitts, 2004). Yet this visually enlightened situation did not persist, and by the mid-20th century Headd (1957) questioned whether newly qualified teachers in the US were equipped to use audio-

visual materials in the way in which newly qualified professionals such as doctors and dentists use the tools of their professions. She described a lack of knowledge among this group as an '*audio-visual 'Achilles' heel' in the teacher education programme*' (Headd, 1957, p. 418). That over 50 years later Yilmazel-Sahin (2009) found slides being read aloud to trainee teachers in the USA suggests that in that country at least, such an 'Achilles heel' may still exist.

The requirements of visual aid design are likely to vary according to the subjects taught. Shulman (1986) refers to '*pedagogical content knowledge*' and defines it as '*that which goes beyond knowledge of content matter per se to the dimension of subject matter knowledge for teaching*' (Shulman, 1986, p. 9). He described a collection of methods by which to make a subject comprehensible to learners; such as analogies, illustrations, and examples as an 'armamentarium'. Such a facility has been created to support trainee post-compulsory teachers; 'OurSubject' (HUDCETT, 2010) is an online resource hosted by Huddersfield University which aims to provide, maintain and develop subject specialist online communities (SSOCs) for educators in the Lifelong Learning Sector. SSOCs provide facilities and resources that support members in developing pedagogies appropriate to their specialist knowledge. However an inspection of 'OurSubject' undertaken for this thesis in 2013 found the site to be devoid of any content that related to visual support for learning.

4.6 Discussion

Adesope & Nesbit (2012) concluded from their meta-analysis of spoken-only, written-only, and spoken-written presentations, that teachers and instructional designers lack an understanding of how learning is affected by verbal redundancy. This finding supports the notion raised in Chapter 3 that some theories of memory which relate to this area may not be included in ITT undertaken by post-compulsory teachers and lecturers. The value of including topics which are related to educational psychology in ITT has been questioned (Hoy, 2000), and the debate continues (Fendler, 2012). Nonetheless, an appropriate starting point for further research might be teachers and lecturers themselves, in order to establish what these (to date) largely silent partners in the visual aid research literature actually know, and aim to do when they create visual support for their lessons and lectures.

From this and the preceding two chapters, the following research questions have evolved:

- What effect does the simultaneous provision of speech and text have in post-compulsory class and lecture room environments?
- What support can visual aids provide for an abstract topic beyond text?
- Can a visual modality support learning without the provision of ‘something to look at’?
- How do teachers and lecturers in post-compulsory education design and use visual aids?
- What factors influence teachers’ and lecturers’ use of visual aids?
- What forms of visual aid should teachers and lecturers of post-compulsory learners use?

4.7 Conclusion

This chapter has examined the literature which relates to visual literacy and proposed three interconnected reasons for the finding that text is often the de facto choice for visual support in post-compulsory education. Firstly, it has identified that images may be seen as having a chequered history as a medium through which educated people may learn; secondly, that visual literacy may not be widely valued as a concept outside of the arts; and thirdly, that teachers and lecturers engaged in post compulsory education may be influenced by these factors, and also by an absence of tuition in this area during their ITT. Further research is required to establish what teachers and lecturers display to their students in practice, and what they aim to achieve with their visual aids.

The following chapter describes the methodology employed in the Lecturers and Modalities studies undertaken in this thesis.

Chapter 5 Methodological issues

5.1 Introduction

This chapter outlines the reasons for the selection of a research design which combines qualitative and quantitative methods. It analyses the advantages and disadvantages of a mixed methods approach in the context of the research questions, and considers the acceptability of this methodology among a target audience of teachers and lecturers in post-compulsory education. Issues concerning research quality are discussed from both positivist and relativist viewpoints. The rationale for conducting the research in two parts is explained, and the data collection and analysis methods are described. Rationales for the sample populations selected are detailed and issues relating to transferability are addressed.

5.2 Selecting an appropriate research design

I wished to gain insight into visual aid design, use and efficacy, and in pursuance of this aim I considered a variety of research techniques, some of which were quantitative and others qualitative. However, methodology choices for many researchers are rooted more deeply than selection of an approach which provides the most insight; for many it is a matter of world view, of personal belief. I first addressed the question of whether my research would sit within a particular paradigm.

Denzin & Lincoln (1994), suggest researchers sit within one of two paradigms, that they view the world through one lens and have one 'worldview'; the implication being that their chosen research methods are likely to be congruent with this view. They describe such differences in approach thus:

'Qualitative researchers use ethnographic prose, historical narratives, first person accounts, still photographs, life histories, fictionalised facts, and biographical and autobiographical materials among others. Quantitative researchers use mathematical models, statistical tables, and graphs, and often write about their research in impersonal, third person prose'. (Denzin & Lincoln, 1994, p. 16).

Guba & Lincoln (2005, p. 201) believe *'the axioms of the positivist and interpretivist models [to be] mutually exclusive'*. However, Pring (2004, p. 45) refers to distinctions such as these as *'an epistemological and ontological apartheid'*, and for

those aligned with one side or another of such a divide, perhaps there are no choices to be made, only finer distinctions of methodologies within a paradigm as suggested by Guba & Lincoln (2005). These differences and the ensuing debates continued through the 1960s and 70s and have been described as the 'Paradigm Wars' (Gage, 1989); the use of a term ordinarily reserved for violent conflict perhaps indicates how some writers believed the debate had deteriorated to a battle.

I held a concern that the selection of one paradigm over another, or as was the case, by not aligning myself clearly with one paradigm, I might alienate readers who strongly adhere to one belief; or that conversely, by choosing a mixed methods approach I might alienate readers from both. My aim was that advocates of each 'world view' should find something with which they could identify in my research, whilst not discovering elements that might distance them from it. Over the course of my teaching career I have periodically delivered lectures on emotive topics to audiences which contain individuals with diametrically opposed views (for example nuclear accidents and the statistical likelihood of such an event). I recognise that revealing a personal bias in teaching can be counterproductive, and I have always tried to address contentious issues in a fair and neutral manner, and have judged the success or otherwise from unsolicited feedback from listeners on both sides of the argument. I have worked hard to achieve such impartiality and believe I have attained some degree of success. In selecting a methodological approach for this research, I found myself in a similar position; I respect views from both sides, but wish to present my research in such a way that readers with strong views about the exclusiveness of one world view or another will nonetheless feel able to draw useful insight.

Notwithstanding differences in world views noted above, there is often a commonality to be found among those who display visual aids which is not constrained to any epistemological viewpoint. Just as most writers of educational research follow a common convention of layout, grammar and punctuation; for example the published writings of Denzin & Lincoln (1994) are similar in appearance to those of Pring (2004), so lecturers of differing epistemological dispositions may adopt similar conventions for visual aid design when they lecture. To illustrate this observation, Figure 5.1 shows from the top; a presentation slide from a writer well known for contributions to interpretivist research (Lincoln, 2006), in the centre is a

slide taken from a science-based lecture at The Royal Society (Harvey, 2010), and at the base is a slide from lecturer notes provided in accompaniment to *Social Research Methods* (3rd ed) (Bryman, 2008); this last slide is proffered as representative of a relatively neutral standpoint. Each slide uses bulleted text and contains over 65 words, and it is this commonality in approach across epistemological divides to which I seek to appeal in my research.

A valid approach to my research questions might have been to design a laboratory-based experiment which contained a dependent variable with which to seek the optimal design of a visual aid for a given learning situation. To a certain extent this has already been undertaken (see for example, Dwyer, 1978; Mayer & Moreno, 2002), however much of the research in this area has concentrated on the teaching of concrete, physical concepts such as the anatomy of the human heart, the operation of a bicycle pump, and how lightning strikes; the assessment of which contains a limited number of clearly identified variables. A significant amount of research into the visual modality has also been undertaken by means of computer-based experiments in which the variables are readily controlled. Consequently many of such inquiries have tended in their design toward laboratory-based experiments which inform the illustration of textbooks and the design of computer-based learning, but which do not readily transfer to an educational environment in which a teacher or lecturer provides the main focus of attention.

In terms of how teachers and lecturers design and use their visual aids, much of the research discussed in Chapter 2 sought only quantitative data; and resulted in an incomplete picture of both visual content and learners' experiences (see for example, Bartsch & Cobern, 2003; Craig & Amernic, 2006; Leahy & Sweller, 2008). I wished to obtain a more complete understanding of how and why teachers and lecturers use

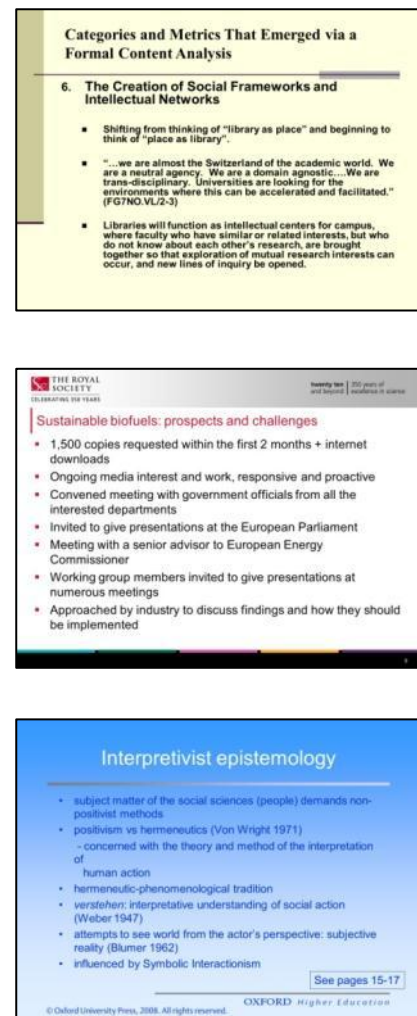


Figure 5.1. PowerPoint slides from lectures of differing epistemological standpoints. From top: Lincoln (2006) Harvey (2010) and Bryman (2008).

visual aids, and would thus need to inquire more deeply into practice than most preceding researchers in this area.

A quantitative inquiry may be employed for some areas of visual aid practice; for example one can state the minimum pixel height required for an image to appear in clear focus when projected onto a screen, or the minimum font size necessary to ensure readability for text-based visual aids. However, one of my research questions, 'What support can visual aids provide for an abstract topic beyond text?' is difficult to answer in quantitative terms due to the large number of variables involved, for example; subject variance; syllabus requirements; individual interpretation; student prior knowledge, and lecturer ability. As well as undertaking an inquiry into different modalities, I wished to discover why teachers and lecturers make the choices they do in their everyday practice. A survey is one method by which one might elicit some data, and this was adopted for the Lecturers exploratory study (see Chapter 8); however I also wished to explore the reasons more deeply than could be undertaken with a questionnaire alone. For this reason I elected to undertake a series of semi-structured interviews with teachers and lecturers in the Lecturers main study.

In addition to maintaining an awareness of those to whom my research is directed, I believe the choice of methods undertaken by a researcher should be appropriate to the research questions, and in the context of this thesis I wished it to support my aim of illuminating the relationship between adult educators and their visual aids in a coherent and open manner. Consequently I see my research questions as, '*more important than the methods used or the paradigm that underlies the method*' (Tashakkori & Teddlie, 2003, p. 21). I am interested in 'what works' for teachers and lecturers, and their learners, and as such I believe my stance to be 'a-paradigmatic' (Tashakkori & Teddlie, 2003). An a-paradigmatic approach may paradoxically be recognised as a paradigm in its own right; taking the name 'pragmatic' (Tashakkori & Teddlie, 1998). Teddlie & Tashakkori (2009) propose pragmatism as a philosophical orientation to guide mixed methods researchers. In a research context the term 'pragmatic' stems from two sources: the straightforward use of the word as an adjective which describes an approach to research questions by using 'what works' (Rocco et al., 2003), and a philosophical stance originating from the writings of Pierce; James; Dewey; Mead, and Bentley (Maxcy, 2003).

Mixed methods

My pragmatic stance led me to adopt a methodological approach which combines qualitative and quantitative methods, known as 'mixed methods'. The term mixed methods as applied to a combination of quantitative and qualitative research in a single study has been expounded by a number of researchers since the turn of the current century (see for example, Ary, Jacobs, Razavieh, & Sorenson, 2006; Creswell & Plano Clark, 2007; Johnson & Onwuegbuzie, 2004; Jones, 2004; Tashakkori & Teddlie, 2003; Wallen & Fraenkel, 2001). These writers support mixed methods as a strategy which moves beyond arbitrary divisions whilst recognising the strengths and weaknesses of both. As a methodology, mixed methods may appear to present a contradiction in terms, an attempt to commensurate the incommensurable from what Greene (2008) refers to as a purist stance. However, an alternative view posits that traditional paradigms are logically independent and can be mixed in different ways; resulting in the adoption of an a-paradigmatic stance (Greene, 2008).

Writing in the period before the acceptance of mixed methods as a methodology in its own right, McGrath (1982, p. 70) suggested '*all research strategies and methods are seriously flawed*', and observed that a strength in regard to one outcome is often a weaknesses with regard to others. He suggested the use of multiple methods can compensate for the vulnerabilities of each. It is interesting to note that Piaget used a mixture of methods in his research into children's thought, and this did not seem to present an issue for readers at the time (Kvale, 2007).

Jones (2004) supports the removal of divisions between methodologies and identifies a paradox (with reference to an interview with Dr Glaser), namely that grounded theory has its origins in quantitative studies, and suggests that the divide between these two types of research '*is not fundamental and hides many of the common features between the two*' (Jones, 2004, p. 109). Ary et al. (2006) suggest that both quantitative and qualitative methodologies are valuable to educational research. They recommend that the choice of methods selected by a researcher should be based on '*the suitability of the particular method to what they are studying and what they want to find out*' (Ary et al., 2006, p. 258). Mackenzie & Knipe (2006) similarly observe that mixed methods can produce research results which are richer. Bloor (2001) suggests that multiple methods may in themselves be an indication of

methodological rigour, and it is such rigour that I wish to employ in order to add meaning to my research for readers of all backgrounds and worldviews. Johnson & Onwuegbuzie (2004, p. 17) suggest that philosophically, mixed-methods represents a '*third research movement*' that moves past paradigm separations. The observations of the above writers were a key factor in my decision to utilise a combination of methods.

I held a concern with regard to transferability of mixed-methods research to an educational setting, and so I investigated the acceptability of mixed methods among my target audience of teachers and lecturers. Creswell & Plano Clarke (2007, p. xv) suggest mixed methods research is in the ascendancy and note, '*Mixed methods research has been gaining in acceptance and becoming more common in studies across social sciences*'. However Flick (2007, p. ix), writes in the same year, '*in recent years, qualitative research has enjoyed a period of unprecedented growth*'. Over the same period, the amount of scientific research published in the western world suggests that a similar claim might equally be made for quantitative techniques. Although the amount of research undertaken may be increasing across all methodologies, I did not wish to select a research method which might clash with that used in the literature closest to my target audience.

Creswell and Plano Clark (2007) devised a checklist against which the level of acceptance of mixed methods in a given discipline might be evaluated, and used the number of studies published in peer reviewed journals of a given discipline as a key measure. By this judgement, my target audience in education has a rising measure of acceptance of mixed methods research; Alise & Teddlie (2010) found a prevalence rate of mixed methods articles published in education journals of 24%. Part of my research involves health professionals, and despite the claimed dominance of the 'medical model' in health research (Polgar & Thomas, 2008; Saks & Allsop, 2007), the proportion of studies classified as 'mixed methods' in healthcare research in England has increased from 17% in the mid-1990s, to 30% in the early 2000s (O'Caithan, Murphy, & Nicholl, 2007). Bryman (2008) notes that mixed methods is sometimes chosen because it is believed to have greater credibility among potential readers, and Creswell & Plano Clarke (2007) reinforce this notion; they suggest one of the advantages of mixed methods is that the inclusion of a quantitative component in qualitative research can make it more acceptable to

quantitative biased audiences. The components selected in my mixed-methods design are described in section 5.4 below.

5.3 Quality

Flick (2007) observes that part of the problem with regard to the establishment of criteria by which qualitative research may be judged is that its many different forms may have little in common, sometimes only that *'they are not quantitative'* (Flick, 2007, p. 6). Many writers agree that measures of validity and reliability as applied in quantitative research do not sit easily with qualitative research methods. Schofield (1990) observes that qualitative research originally tended to be associated with cultural anthropology and single case studies with no attendant wish to generalise, but since the 1980s this form of inquiry has been widely used in educational research, with a desire for the results to be useful to others and to inform decision making. The terms 'reliable' and 'valid' exist in everyday speech, and for those new to educational research it may appear strange that their use to describe quality in research can evoke strong reactions from researchers of a relativist persuasion and from qualitative researchers generally. Yet in the vernacular sense of the terms, most researchers would presumably not wish their work to be described as either 'unreliable' or 'invalid'. Robson (2002) observes that the removal of these terms by qualitative researchers can provide support for a view that qualitative studies are to some degree unreliable and invalid. He suggests one reason for their lack of acceptance is their rigid application in quantitative research.

Some interpretivist researchers eschew generalisability in any form. Williams (2000) suggests otherwise, he adds human fallibility to the equation by drawing a comparison between interpretivist attitudes to generalisation and the Victorian attitude to sex, namely *'they do it, they know it goes on, but they rarely admit to either'* (Williams, 2000, p. 210). He offers the term 'moderatum generalisations' as an appropriate way to describe the modest degree of generalisability that may be achieved from qualitative research. Kvale (1996) refers to the reaction against the concepts of reliability, validity and generalisation as an example of *'rampant antipositivism'* (Kvale, 1996, p. 231), in which the terms are ignored by many qualitative researchers. Robson (2002) suggests that in the everyday sense of the word, reliability should comprise evidence that the researcher has been thorough, careful and honest. He suggests a way forward may be to find different ways of

'operationalising' the terms reliability and validity so they become appropriate to qualitative enquiry (Robson, 2002), a hope which is echoed by Trochim (2006). Lincoln and Guba (1985) provide a less contentious way to ensure a degree of acceptability across differing worldviews by offering definitions which parallel the conventional criteria of internal validity, external validity, reliability and objectivity, collectively described as establishing 'trustworthiness' (Lincoln & Guba, 1985). For internal validity they suggest the analogous term 'credibility'; for external validity the analogue 'transferability'; for reliability, 'dependability', and for objectivity, 'confirmability'. The collective term 'trustworthiness', is another parallel, in this case for 'rigour' (Lincoln & Guba, 1985).

Without wishing to overtly align with any side of the paradigm debate, I chose to establish quality using these terms, and reliability and validity (in the vernacular sense) without making an issue of the terms themselves. I wished the reader to find credibility, transferability, dependability and confirmability as satisfying elements of the research for themselves, without having to seek items from a mental checklist, either positivist or naturalistic. Ary et al. (2006, p. 498) define credibility as how well *'the researcher has established confidence in the findings based on the research design, participants and context'*. They reinforce this by pointing out that the researcher has an obligation to represent the contributions of the participants as accurately as possible. As well as using this as a guiding principle through my interpretations, the credibility of this study will also be checked by my provision of all participants with a summary of the results and analysis.

Generalisability or transferability?

For my research to have a function beyond its own existence, teachers and lecturers should feel able to gain some insight from the results. This insight should be useful to them to the degree to which they feel able to transfer the findings to their own situations. The wide variety of subjects and learners in the arena of adult education, which range from HE through FE and work based learning, mean it is unrealistic to aim for conclusions generalisable to all. Nonetheless I can strive to provide data which is credible, and available for transference for those who might use the results as the basis for a working hypothesis in their own professional communities. Flick (2007) suggests one question to be answered with regard to credibility is *'has your*

research provided enough evidence for your claims to allow the reader to form an independent assessment – and agree with your claims?’ (Flick, 2007, p. 20).

Schofield (1990) believes a thick description (discussed below) to be crucial in order for the reader to make an informed judgement about the issue of fit, namely how well the situation studied ‘fits’ with the other situation to which the reader may wish to apply the conclusions of the study. Mertens (2010) points out that with the concept of transferability the burden of proof for generalisability lies with the reader; the role of the researcher is to provide a sufficiently thick description to allow the reader to make the judgment as to how well the research results may be applied to another setting.

Kvale (2007) differentiates between statistical and analytical generalisation, the former represents the quantitative approach to external validation, while analytical generalisation involves a judgement about how well the findings can be transferred to another situation. Sim (1998) refers to this process as ‘*theoretical generalisation*’ (Sim, 1998, p. 350), and posits that data which provides theoretical insight may allow its projection to other comparable contexts. Kvale (2007) differentiates between researcher-based and reader-based generalisation; in the former the researcher offers arguments for generalisation as well as a rich description, while in the latter it is the reader who judges the relevance or ‘fit’ to a new situation. In this research, I have marshalled my arguments towards the support of credibility and leave it to the reader to make their own judgements based on the richness of the description provided, although in places I have proposed theoretical insight as described by Kvale (2007) and Sim (1998). Gomm, Hammersley, & Foster (2000) suggest that case studies are often of sufficient interest in themselves to a target audience for the findings to have intrinsic value.

Mertens (2010) suggests that an appropriate approach to assess the quality of a mixed methods design is to look at the integrity of the methods from the assumptions of each relevant paradigm. However, an attempt to assess the quantitative component explicitly by validity and reliability might force an epistemological clash such as that I wished to avoid; a less contentious option is to do as Mertens (2010) suggests but without making it overtly clear.

The question for many readers is likely to be, 'is there sufficient information here for me to make an informed judgement?' In Geertz's (1973) concept of a 'thick description', such an account aims to be detailed and broad enough to provide sufficient information for readers to make such an informed decision. Schofield (1990) points out that a thick description (of both the site in which the studies are carried out and that to which one wishes to generalise) makes it possible to form a '*working hypothesis*' (Schofield, 1990, p. 180) of what might be the case in the other situation. Flick (2007, p. 20) suggests the qualitative researcher should provide sufficient evidence to allow the reader to form '*an independent assessment*', and it is such an assessment, which may lead to a working hypothesis that I aim to create in the minds of my readers. In this way, unlike generalisation undertaken in quantitative research, the degree to which my results are generalised will be in the hands of the reader, and it will be for them to judge how well the results transfer to their own context. The makeup of the samples selected in both the exploratory studies and the main studies also impact upon transferability of results, and these are described in the relevant chapters below.

5.4 Ethics

Each of the two exploratory studies and the ensuing two main studies raised ethical issues and the manner in which these were addressed is outlined below.

Modalities exploratory study

Six lectures formed the basis of the Modalities exploratory study and all were undertaken during separate pre-planned study days for National Health Service (NHS) staff. I was the facilitator of these events and all participants were known to me. The lectures which formed the basis for the study were not part of the advertised programme and consequently required agreement from participants in order to take place. To this end, at the commencement of each day I explained to all attendees that I was undertaking research into the effectiveness of certain teaching methods, and that I sought their permission to include a short lecture based on the evolution of language and communication.

Guideline 11 of the British Educational Research Association (BERA) Ethical Guidelines for Educational Research (BERA, 2011) advises researchers to take all necessary steps to ensure participants understand the process, how the research is

to be used, and how it will be reported. Cognisant of this advice, I explained that some groups would receive the lecture delivered in a slightly different way, but that I did not wish to disclose the precise details because of the possibility that the results might be skewed if participants attempted to compensate for the variable, either consciously or otherwise. I provided assurance that once the study was completed, I would feed back the results to the group members. I also assured everyone the research did not involve anything outside of the boundaries of normal assessment and evaluation of teaching, and also that individual anonymity would be preserved.

BERA (2011, g. 20) cautions against a research process causing distress or discomfort, and I was aware that because the lecture was based on a contemporary theory of evolutionary psychology, there may be some participants for whom evolutionary theory was not acceptable. To minimise the possibility of any discomfort caused by the choice of subject matter, I explained prior to commencement of each lecture that there were many alternative and equally valid points of view in this arena, and requested that participants look upon the lecture as representative of just one of many theories. Participants should be able to withdraw from research at any time (BERA, 2011, g. 15), and I emphasised that no-one should feel they had to take part. I was nonetheless aware that because I was acquainted with everyone who attended the events, they might feel obliged to participate. With this in mind, I situated the lecture immediately before the planned coffee break to allow anyone who did not wish to take part to comfortably withdraw by commencing their break a little earlier.

All participants were employed by the NHS which has an established research application process, and I submitted my proposal for the Modalities exploratory study to my local ethics committee. They decided that I did not require approval for this study and informed me accordingly.

Lecturers exploratory study

Many of the respondents in the Lecturers exploratory study were known to me, and each participant was recruited by means of an e-mail, in which I outlined the purpose of the research, and provided an assurance of anonymity. I also recruited 18 students who were undertaking their initial teacher training from my local college through their course tutor. These participants were not known to me, so I visited the

college during one of their lectures in order to meet them and to provide a personal explanation and assurance of anonymity before I supplied the surveys.

In addition to BERA guidance which entreats researchers to take steps to minimise experiences which might cause discomfort (BERA, 2011, g. 20). I felt some questions contained in the survey instrument might elicit a response which suggested a degree of inadequacy in the respondent's knowledge of visual aids. In order to minimise the likelihood of this happening, and to encourage honest responses, I ensured all respondents understood the questionnaires were anonymous, and that I would be unable to identify respondents beyond their stated teaching environment and teaching qualification.

For the ITT lecturers and students I requested permission and ethical approval from the senior tutor of the ITT team at Somerset College. She informed me I did not require formal approval for members of her teaching team, or for her students to participate in the study.

Modalities main study

Although more complex than the Modalities exploratory study, the Modalities main study similarly utilised a short lecture delivered to NHS staff who were on duty. However, this study differed in that this lecture formed part of an existing programme. This raised an additional ethical issue; namely the potential for differences in design to advantage some groups more than others (BERA, 2011, g. 24). This presented a cause for concern because participants were all health service professionals and the subject matter was regarded by senior managers of the organisation as essential for all staff to embody. Consequently I requested permission to conduct my Modalities main study through the NHS Research Ethics Committee (NHSREC) system. I was informed by the local committee that I did not need to follow this route because they viewed my research to be in the same vein as existing evaluations of teaching. On a local level, I shared my concern with my Director and provided assurances that each of variants used in the main study would be adequate for the task and would employ an accepted teaching method. In this way, I ensured the desired learning outcomes were retained and achieved across all lectures involved in the study, including the pilots. On the instructions of the College Ethical Committee, written consent was retrospectively obtained from the hospital

staff and patients who appeared in the slides. However, for reasons of sensitivity, patients' faces in the photographs that appear in this thesis have been blurred.

At the commencement of each event, I informed all participants that I was undertaking a study which aimed to improve the quality of teaching in the organisation. Silverman (2005, p. 55) cautions against '*contaminating the research*' by providing too much information for participants, and I balanced this with a regard for participants' rights by informing everyone present that the whole event was under review, and added that if I were to explain precisely what I was researching, it might affect the results. In this way, everyone was aware that the event was involved in a research project, but not of the precise detail. When I administered the recall test, I explained that no-one was obliged to take part in the assessment if they did not wish to do so. At this point I also mentioned that I had provided quality biscuits for everyone at the coffee break in anticipation of their cooperation, and included a light-hearted aside to the effect that they could choose not to participate and still enjoy the biscuits.

When I later requested volunteers for focus groups to take place in a different room, I explained the nature and purpose of the groups, and requested volunteers. I also offered the volunteers freshly made coffee and doughnuts as a combination of incentive and appreciation of input. Robson (2002) and Morgan (1998b) caution that confidentiality may be a problem between focus group participants, and mindful of this advice, I affirmed my confidential approach to each group at the beginning of each meeting. On the instructions of the College Ethical Committee, written consent was retrospectively obtained from the participants in the focus groups for the proceedings to be recorded by video for transcription purposes.

My control over confidentiality was potentially limited because of the possibility that some members might repeat elements of the conversation outside of the group. The lecture concerned organisational values which had been defined by senior management, and the topic contained a potential to elicit feelings and opinions which members may not wish to be communicated to senior managers, at least not in a form attributable to individual members of staff. By obtaining involvement and open discussion from everyone in the focus groups, I strove to achieve a sense of complicity among participants. Further to this, I obtained verbal agreement at the

commencement of each group that the conversation would remain between us. I also provided assurances that although I would transcribe the conversations, all transcriptions would be anonymised, and that no-one apart from myself would have access to the original recordings.

I was especially mindful that the lectures which included text-based visual aids might uncover reading or dyslexia-related issues. Focus group members were all volunteers, and I believed self-selection was likely to filter out anyone with reading or language difficulties that they might not wish to disclose. Nonetheless I remained vigilant among the groups who had received text-based modalities for any discomfort which might have indicated such a difficulty.

Lecturers main study

Each potential interviewee received a personal invitation to participate in the study; either by e-mail or by telephone, and following acceptance, a mutually convenient time and location was agreed. Of the 31 participants, I had met 28 at least once before, and the remaining three were known to my supervisor. All participants were assured of anonymity and confidentiality at the commencement of each interview, whether face to face or telephone. At the commencement of each interview I asked each respondent if they were happy for me to record the conversation for the purpose of transcription, both in face to face interviews, and also for those which took place over the telephone.

Because the interview questions sought information which related to professional practice, and included the possibility that an interviewee's expertise might not be as complete or developed as they might wish, this study brought the issue of possible discomfort (BERA, 2011, g. 20) to the fore. In particular, I was mindful of Oppenheim's (1992) caution against posing questions which might require an admission of reprehensible behaviour. Whilst I believed it unlikely that any responses would warrant such a description, my interview sample included teacher educators who one might expect to possess a high level of knowledge, and for whom an admission of lack of skill or understanding might create a sensitive situation. I designed my questions to take this into account, and I neither made nor offered any judgement on individual responses. This remained at the forefront of my mind throughout all interviews undertaken.

Each interview transcription was allocated a coded name during transcription so that responses reported in study results could not be attributed to any person or establishment.

My research plan was submitted to the University of Exeter Ethics Committee for approval, which was duly granted (see Appendix 18).

5.5 Conclusion

This chapter has described the process by which the research design was decided upon. It has outlined different world views held within the research community regarding paradigmatic approaches, and explained how for the studies undertaken in this thesis, a mixed-method approach was chosen to combine the best of both methods whilst maintaining readability and an element of transferability for researchers and readers of differing methodological persuasions. The chapter has described the rationale and design of the two exploratory and the two main studies undertaken in this thesis, and has outlined the ethical approaches taken toward each study.

The next chapter reports on the Modalities exploratory study.

Chapter 6 Methods employed

6.1 Introduction

This chapter details the methods employed in the quantitative and qualitative studies undertaken in this thesis. It describes the approaches used in Modalities exploratory study, the Lecturers exploratory study, the Modalities main study, and the Lecturers main study. It explains the choices of methods used, and provides details of the methods of analysis.

6.2 Modalities exploratory study

The modalities exploratory study comprised an intervention study in which a short lecture was supported by one of two alternative sets of visual aids; one set comprised slides composed of 'bullet-pointed' text laid out in a standard PowerPoint template, a format described as in frequent use in HE lecture environments (Yilmazel-Sahin, 2009; Young, 2004), and an alternative set which comprised the same number of slides composed entirely of graphics sourced from Internet image searches.

The lectures were delivered to an opportunity sample of participants available to me who were attendees on a supervisory course taught by myself. Each participant was engaged in a supervisory role in a NHS District General Hospital. The interventions were applied to six separate groups; three groups received visual support in the form of text-based PowerPoint slides categorised as 'traditional' in design, and given the title 'Trad-PPT' (n=40), and three groups received the lecture supported by slides which were composed of graphics obtained from Internet image-searches. The latter contained no text, and was assigned the name Net-Graphics (n=37). Each lecture contained the same spoken content, and the visual aid sets were randomly assigned to groups by an assistant who supported me in the delivery of the study days. For each lecture, I was unaware which set of slides was being shown and avoided looking at the screen during delivery to ensure I did not alter my speech to match the visual aid design.

Immediately after the lecture, each participant received a questionnaire (see Appendix 2) which sought to evaluate their appreciation of the lecture and of the visual aids used. This instrument comprised 6 questions with Likert scale response options. 14 days later, all participants received a postal questionnaire which

assessed recall of lecture content (see Appendix 2). Once the completed questionnaires had been returned, 5 respondents from each group were randomly selected and invited to attend an individual interview about their experience of the lecture and the content they had been able to recall.

Analysis of results

The responses to the Likert questions were collated into tables in which the modes were identified for each question, and these were compared visually between the two modalities. Responses to the 'any other comments' section of the questionnaires were compared for each modality, and are summarised in Chapter 7.

A 70% response rate was achieved from the 14 day recall questionnaires, and the returned responses were tabulated. Because the lecture participants had not been randomly selected and thus I could not claim them to be normally distributed, a non-parametric test was selected to compare the numbers of correct answers for each modality in order to establish whether any significant difference existed between the group scores. A Mann-Whitney U test was carried out and the results are reported in Chapter 7.

9 participants agreed to be interviewed; 4 from Trad-PPt and 5 from Custom-Graphics. The interview notes were examined for any themes which might inform the Modalities main study, although these were found to produce only limited data as interviewees appeared to have forgotten much of the lecture content over the ensuing period.

6.3 Lecturers exploratory study: Survey

I commenced my inquiry into teachers' and lecturers' knowledge and practice with an exploratory survey undertaken by means of a paper-based questionnaire administered to an opportunity sample of 64 teachers and lecturers. Although questionnaires may not always be adequate as a research method on their own (Gillham, 2000); I chose this method because it offered an economical means by which I could gain sufficient insight into the use of visual aids by teachers and lecturers to inform the design of the main study, in which I proposed to use a more personal method of inquiry.

Gillham (2000) observes that the quality of data is often limited by the nature of the instrument; an inherent weakness is that they seek answers to questions to which the researcher has already decided on the possible answers. However, taking such limitations into account, questionnaires offer a logistically economical way to acquire a broad picture in terms of ease of analysis, respondents' anonymity, and cost (Cohen, Manion, & Morrison, 2000), and it was such an approximation that I wished to achieve.

A possible drawback of this method of data collection is a misunderstanding of meaning on the part of respondents; additionally it is not possible to check the honesty of the answers (Gillham, 2000). Another difficulty often associated with questionnaires is a low response rate (Baruch & Holtom, 2008), and I planned to limit this factor by asking all respondents if they would be prepared to participate, before I administered the questionnaires. I believed such a personal approach would also reduce another potential risk, namely that some respondents might not take all of the questions seriously.

Gillham (2000) observes that many researchers write questions off the top of their heads and cautions against this practice; he points out that respondents are often drawn from groups quite different to that of the researcher. In the Lecturers exploratory study the respondents originated from a group broadly similar to my own, in that they were all teachers or lecturers employed in post-compulsory education. Nonetheless, I was mindful that I may devote more thought to the research topic than some of my respondents, and should therefore be wary of any 'false consensus effect' (Ross, Greene, & House, 1977) in which a researcher believes others think as they do. Additionally, I believe it was important to ensure I designed a questionnaire that respondents felt motivated, willing, and able to answer (Bourque, 2002; Czaja & Blair, 2005).

I chose 5-point Likert scales for the body of the survey in accordance with the advice of Anderson (1998), who recommends this format as practical for most purposes, and suggests it is '*easy to respond to and straightforward to analyse*'; he adds that such scales provide '*an excellent means of gathering opinions and attitudes*' (Anderson, 1998, p. 174). Oppenheim (1992) warns that the existence of a neutral mid-point in the scale may lead to 'lukewarm' responses, and Fink (2003) advises

that a neutral category should only be included if it represents a valid response. I chose to retain the neutral option due to the notion implicit in much of the literature reviewed in Chapter 3 that lecturers' knowledge in this area might not be high, and some may thus feel ambivalent toward some of the questions. Fink (2003) notes respondents might resent not having a neutral point and being forced to accede to a degree of opinion they do not hold. Cohen, Manion, & Morrison (2000) caution that some respondents may not want to be seen to choose answers at the extreme ends of the scales. I included the option '*don't know*' in the knowledge-based questions to reduce the possibility that respondents might attempt to guess the correct answer.

Gillham (2000) advises that questionnaires often raise more questions than they answer, and in this instance the raising of further questions was part of the desired outcome in order to inform the Lecturers main study.

Analysis of survey results

The survey results were entered into Microsoft Excel. From the totals for the Likert scale questions numbered 1-15, modes for each set of responses were identified, and these were compared visually to gain insight into participants beliefs with regard to visual aid use. Questions 16-20 sought to assess five elements of general knowledge regarding visual aids, and the number of correct answers provided was collated to indicate a level of technical knowledge for this group, with the aim of providing insight to the nature of training received by participants in this subject area. The number of correct responses was not high, and for Question 17, which asked what minimum pixel height was necessary for an image inserted into PowerPoint not to be blurred when shown full-screen, no correct answers were received.

Statistical analyses were carried out on the responses to the general knowledge questions. A non-parametric test was selected because the participant groups could not be assumed to be normally distributed. Mann-Whitney U tests were applied to compare numbers of correct answers between teachers and lecturers in possession of a teaching qualification and those without, and to establish whether there were any significant differences between the scores of these two groupings. A further Mann-Whitney U test was applied to establish whether any significant difference in knowledge was evident between those whose teaching employment was university-based and those who were work-based. The results are presented in Chapter 8.

6.4 Modalities main study: Intervention study

In the Modalities main study, the impact of four separate visual modalities was compared when used in support of lectures with common spoken content. In planning and designing the study, I had a choice of whether to undertake my inquiry by means of an intervention study or as an experiment. As noted in Chapter 2, many investigations reported in the literature from the arena of visual perception are laboratory-based experiments, and although these provide useful data, in the context of this thesis many are not directly transferable to a lecturer-led educational setting because they frequently involve short, closely-paced sections of computer-based learning (see for example, Moreno & Mayer, 2002) . If I had wished to measure the effect on recall of a single variable, I could have conducted a field experiment. However, the results of the Modalities exploratory study suggested a deeper level of inquiry than measurement of recall would be required in order to fully explore the impact of variations in visual modalities. In a control group study or quasi experiment, the researcher has a hypothesis which is tested in some way, however I felt the literature did not provide sufficient data with regard to the impact of text on learners when used as a visual aid, or of what effect relevant images have in such an environment, to write a hypothesis. Furthermore, both the Modalities exploratory study and the first pilot of the Modalities main study had produced only limited data with regard to what had taken place on the part of learners when they saw visual aids in accompaniment to speech. So rather than carry out an experiment, I decided to undertake an intervention study in which different visual aid modalities were used in support of a short lecture. The modalities selected were:

- i. Custom-made images with no accompanying text
- ii. Minimalist text comprising five words or fewer per slide
- iii. 'Traditional' text-based summary of the lecturer's spoken words.
- iv. Imagery guided by the lecturer

These were chosen because they represent design options readily available to teachers and lecturers which do not require a high level of instructional design skill, such as that which might be provided by an instructional technologist.

Abbasi (1999) cautions that many educational interventions which take place within the health services comprise a thin description that says little more than whether

students liked the innovation. I wished to provide more substantial data in order to provide insight into visual aid use, so the Modalities main study combined three elements; a quantitative assessment of recall of key phrases, a qualitative evaluation of learner preferences, and a qualitative analysis of focus group conversations which examined engagement and affect. A key element of the design was the inclusion of focus groups through which I aimed to obtain a deeper level of insight than that available in an experiment, and the rationale behind the selection of this methodology is explained later in this chapter.

Group composition

Participants in the Modalities main study were a cross-section of NHS staff who attended mandatory study days in which a series of lectures were delivered on subjects which are deemed essential knowledge by the employing organisation. Attendees ranged from support staff to managers and registered professionals such as nurses and doctors. I was unable to randomly assign participants to groups due to the pre-booked nature of the study day environment utilised for this study. Hsieh et al. (2005) believe the challenges presented with random assignment in educational research may adversely impact upon the numbers of researchers using this method. However, Levin & O'Donnell (1999) suggest that it may not always be necessary to randomly assign students to class groups for educational research, and that the intervention conditions may be randomly assigned to classes. I endeavoured to reduce selection bias as much as I was able by three means. Firstly, I randomly assigned the intervention modalities to study day dates, and did so without any knowledge of group composition. Secondly, the distribution of staff grades and professions who booked onto these events, and thus which intervention the subjects experienced, was outside of my influence because participants allocated themselves to the days on an individual basis subject to release from departmental duties. Thirdly, I chose update days which are mandatory for all grades of staff within my employing organisation to attend, and in this way I was able to involve a spread of professions and educational abilities.

Analysis of post-lecture questionnaires

The post-lecture questionnaires administered in the Modalities main study contained two sections (see Appendix 10); at the top were spaces for respondents to write the

Value statements they were able to recall from the lecture, and beneath these the lower section of the questionnaire contained seven Likert scale questions which inquired into their reaction to the visual aids used. The Likert questions were placed below the recall test so that respondents' judgements would be made after the experience of attempting to recall the lecture content. The wording of the questions was amended for the Guided-Imagery questionnaire to reflect the different presentation modality, and an extra question was added which asked whether participants would have liked to see visual aids 'instead/as well' (see Appendix 11).

Recall of the lecture content was assessed by checking answers against criteria which set out which words should be present in order for the response to be judged correct (see Appendix 12). For example, for Value 1, '*Put Patients First*', the word '*patient*' was regarded as essential, while accepted alternatives to '*first*' could be '*at the centre of all we do*'. Conversely, '*we are here for the patients*', was judged to be too far removed from the Value definition. The number of values correctly recalled for each of the four interventions was then collated and presented in the form of bar charts. As I undertook this process, I became aware that some respondents from the Custom-Graphics and Guided-Imagery groups had provided answers which were incorrect by the standards I had set, but which nonetheless demonstrated recall of what they had seen (or imagined). This introduced an additional factor, and these answers were collated into a second data set and are displayed as hatched areas on the charts displayed in Chapter 9. The data recorded from the seven Likert-scale modality-appreciation questions were tabulated and presented with modes underlined to facilitate visual inspection.

I wanted to establish whether a significant difference existed between the numbers of correct responses recorded by each of the four modality groups. As the groups were not randomly selected, I required a non-parametric test to analyse the data, so I carried out a Kruskal-Wallis test, and the mean ranks were inspected to establish which group obtained the highest and lowest scores. As a significant difference was found, and I then carried out Mann-Whitney U tests with Bonferroni adjustments on pairings of groups in order to establish which groups were statistically significantly different to each other in terms of numbers of values correctly recalled. The results are presented in Chapter 9. Recall scores for individual Values were presented as

bar charts for each intervention group, and these were compared to establish whether the nature of the Value statement itself may have impacted upon recall.

The results from each set of Likert scale 'appreciation' questions were combined into a single table (see Table 9.7) and a visual comparison was made. Differences between modalities were evident, and a Kruskal-Wallis test was carried out on a sample question in order to establish whether any significant difference existed between modality groups for responses to this question. As a significant result was obtained, and one modality was ranked lowest, Mann-Whitney tests were then carried out between pairings which included the lower-scoring modality, in order to establish which pairing(s) contained significant differences in appreciation. Results are presented in Chapter 9.

I wished to establish whether there were any significant differences in results between professionally registered staff and unregistered staff groups. This was because I was aware that registered NHS staff are generally confronted with significantly more textual information, both in the course of their duties, and in the form of professional updating, than non-registered staff. As I could not claim the groups were normally distributed, I carried out a Mann-Whitney U test between registered and non-registered groups for recall scores. I also wished to establish whether there were any significant differences in appreciation between these two groups. To do this, I selected the same sample question chosen for appreciation between modality groups described above, and carried out a Mann-Whitney U test for each modality group between registered and non-registered participants for responses to this question. The results are presented in Chapter 9.

Focus groups

I wished to obtain a richer set of data than that available from questionnaires alone. To achieve this, I could have undertaken individual interviews with participants who had been randomly selected; however I chose focus groups over interviews for three main reasons: firstly I wanted respondents to reflect on their experiences and explore how their views were formed, Kitzinger & Barbour (1999) suggest a focus group environment facilitates such shared reflection. Conversely, in the Modalities exploratory study the participants that I interviewed appeared to feel that their inability to recall content was a reflection on them, (this may have been exacerbated

by the fact that I both delivered the lecture and undertook the interviews) and they appeared to feel they had let me down in some way. Additionally, the interviewees had only been able to recall minimal detail with regard to the lecture content. I believed the shared sense of involvement offered by a focus group held on the same day as the lecture would provide a position of relative security for participants to comment upon their experiences. In this way, I hoped a group environment would engender a feeling of empowerment and stimulation among group members, and to some degree continue the shared experience which commenced in the lecture theatre earlier in the day.

My second reason for choosing focus groups was that in the pilot for the main study, I had found that staff could remember almost nothing when I had telephoned them 10 days later, so I resolved to undertake this section of the inquiry closer to the event. However, because the memory of the lecture content appeared to have a short 'half-life', I required interviews that were separated by a common temporal distance from the experience; a feat that would otherwise be difficult to achieve due to all staff being on paid duty. Whereas, because I had the opportunity to hold focus groups in the coffee break on the morning of the intervention, all participants would have experienced a similar lapse of time between attending the lecture and the opportunity to discuss their experiences.

Thirdly, focus groups offer the opportunity for efficiencies in time over individual interviews (Robson, 2002), and allowed access to the numbers I required without encroaching on paid time, due to participants' availability during the planned 30 minute coffee break on the selected study days.

I believed the nature of the group discussions was such that we were unlikely to enter sensitive areas because the discussion was primarily about a professional practice which I demonstrated and not the participants (as was the case in the Lecturers main study). Nonetheless, the groups required careful management in order that any less articulate participants felt safe and able to share their views (Robson, 2002).

The overall aim of the focus groups was to explore how the visual aids impacted on the learning process. I was interested not only in the effect of visual aids on recall and engagement, but also on motivation among the learners. Kitzinger & Barbour

(1999) suggest that although questionnaires are appropriate for obtaining quantitative information such as how many people hold a certain predefined opinion, focus groups are more effective for exploring how points of view are formed. Morgan (1998b) observes that researchers sometimes seek to learn about things participants rarely think about, and although visual aids are widely used in adult learning, I wished to inquire beyond participants' appreciation of the modalities used, to finding out why they felt what they did, what they were conscious of while they watched the displays, and what choices they made.

The Focus Group approach may be described as '*a group discussion exploring a specific set of issues*' (Kitzinger & Barbour, 1999, p. 4). This method of data gathering was developed in the 1940s as a way to judge the effectiveness of wartime propaganda (Morgan, 1998b), and the term 'Focus Group' emerged from 'Focussed Group Interviews' (Robson, 2002). These originally provided an opportunity for researchers to ask a number of people structured interview questions simultaneously. Focus groups differ from group interviews in which members are expected to provide answers to prepared questions, in that they allow the group members to develop the conversation themselves; a practice described as '*retrospective introspection*' by Bloor et al. (2001, p. 2). Robson (2002) observes that in focus groups participants are '*empowered and able to make comments in their own words, while being stimulated by thoughts and comments of others in the group*' (Robson, 2002, p. 285). Kitzinger (1994) notes a particular value of focus groups lies in their ability to uncover information not elicited by survey questionnaires, which then provide an opportunity for a moderator to ask why a particular response was made. Thus focus groups may provide information which has not been anticipated, and for which questions have not been prepared or envisaged by the researcher. In this way I hoped to gain deeper insight than previous studies which have only examined student preferences for visual modalities (see for example, Bartsch & Cobern, 2003; Dekeyser, 2001; Susskind, 2005).

Bryman (2008) notes that in focus groups, participants are able to raise issues they themselves deem to be important, and one of my aims was to discover as much as possible about what participants felt about visual aids, rather than limit their answers to areas which I believed to be important. Barbour (2007) notes that participants may change their minds in a group discussion, particularly when the topic is one

which they may not have consciously thought about before. Additionally, Bryman (2008) observes an interviewer is unlikely to challenge an opinion expressed in the way that a fellow group member may do so, and the resulting argument may produce more realistic accounts as a consequence.

A focus group offers the opportunity to discover what participants genuinely feel, and has been described as 'structured eavesdropping' (Powney, 1988). As well as listening, a moderator needs to probe; Fern (2001) suggests a reason to probe is that it provides an opportunity to pursue responses which in a questionnaire might be invalid, whereas in a focus group the moderator has the opportunity to ask the respondent to expand on what they mean. It was this element I wished to take advantage of in order to discover more about how learners experience visual aids, what feelings they experience, and what decisions they make while watching and listening.

Bloor et al. (2001) point out that a facilitator should facilitate and not control the group, and Morgan (1998b) suggests a moderator who is highly involved can probe more effectively into what is required than one who is neutral, and cautions that they need to ensure not to impose their own sense of what is interesting. Sim (1998) also cautions against moderators who convey a sense of expertise, even though the topic may be close to their professional interests. He suggests moderators should confirm they are there to learn from the participants; advice to which I adhered at the commencement of each group. Morgan (1998a) suggests that a less experienced focus group moderator who has more contact with the issues will produce better data than one who has never worked in the area.

I was not an experienced focus group moderator; nonetheless my strong interest in the subject made it difficult at times for me not to include my own opinions, although I believe my interest and enthusiasm for the subject added an energy that might not be present with a moderator from outside the subject. At the same time I was mindful that, as Krueger (1993) reminds moderators, however much I know about the subject, my role was to learn from others. As Kreuger (1993, p. 84) explains, I was to be a *'sponge soaking up and absorbing information from the participants'*. Fern (2001) goes further, and suggests the moderator should blend in with participants, and that they should ideally come from the same population; yet despite

this observation, Fern (2001) also suggests the use of a professional moderator may be beneficial. There were two reasons I did not choose this option; one is that of financial constraint, the other that I am an experienced facilitator, albeit without experience of focus groups. Barbour (2007) notes the researcher's persona can impact on the form and content of data which result from focus groups and suggests this inevitability has to be recognised. Although I could not completely exclude personal biases from the process, I could, as Fern (2001) suggests, strive to ensure I accepted all responses equally, whether consistent with my own beliefs or not. I also believed I would be more likely to persuade staff to attend the groups than a facilitator unknown to them.

In the Modalities main study focus group participants varied from highly qualified professionals such as senior doctors and consultants through to support staff with no formal qualifications. Morgan (1998b) introduces the concept of 'social loafing' whereby in a large group, some members may allow others to carry on the conversation without them. I believed the combination of small group size and voluntary membership would reduce the likelihood of such reluctance occurring. I did not wish to disrupt the other lectures delivered during the event, so my only opportunity to hold the focus groups was either in the coffee break or at the end of the morning. The option of holding it on a different day was discounted for practical reasons of persuading participants to attend, and also the disappointing results from delayed interviews in the first pilot which indicated a high drop-off rate for the subject matter in participants' memory. I selected the coffee break because all participants remained in the building at this time, whereas at the end of the morning everyone returned to their workplace. Barbour (2007) recommends offering some form of motivation or remuneration; I chose to add a motivational factor by offering fresh doughnuts, biscuits and freshly brewed tea and coffee for those who participated (refreshments were available for remaining participants, although these comprised catering grade drinks and no cakes).

The size of the group was decided upon as six. Morgan (1998b) suggests six to ten members while Barbour (2007) suggests a maximum of eight, and points out that the larger the group size, the harder it becomes both to moderate and to analyse. A limitation for me was time; I had a maximum of thirty minutes in which to run each group before they were required to return for the next lecture. This allowed an

average of five minutes input from each member. When volunteers were requested for a focus group, I selected six to participate in a separate room. In focus groups used by Pippert & Moore (1999), participant response was initially too low to be valid (only 3 from 36 invited), in their second attempt, the group timing was located within the study day itself, in this way the researchers avoided the problem of 'no-shows'. I followed this principle in my research setting, and invited members from the existing group of attendees. The groups were homogeneous in that they comprised adults employed by the National Health Service (NHS), yet they were also heterogeneous in that they contained members from different professions, gender and ages. Robson (2002) observes that homogeneous groups provide a sense of safety, while Fern (2001) suggests they are more likely to provide similar responses which may reduce the richness of the data. However Barbour (2007) observes that even if apparently like-minded people are selected for a group, it is unlikely they will be of the same opinion regarding the topic in question. I believed the relative heterogeneity provided by selecting different professions (as far as I was able) would produce a diversity of opinions and experiences within the groups. I was alert to any inclination to select voluble participants, as Barbour (2007, p. 64) cautions that focus groups are often drawn from the '*chattering classes*'. Bloor et al. (2001) caution against groups formed from pre-existing work groups because of the hierarchical relationships that may already exist and which may affect the discussion. Some participants who attended the study mornings may not have made optimal use of educational opportunities during formal education, and might perceive a focus group as reminiscent of an environment in which they were not comfortable, and this may have limited the number of this group who volunteered. Conversely, as a long-standing member of staff, I was known to (and I believe trusted by) most participants.

Possible disadvantages of Focus Groups

Bloor et al. (2001) suggest focus groups may be used as triangulation in a multi-method design. However, they believe triangulation may not have the validating role ascribed to it (in particular that it is not a parallel for replication in quantitative research) because data produced by one method cannot be directly compared with that from another. Bloor et al. (2001) add that nonetheless, this should not exclude the usefulness of mixed methods. I needed to balance this notion against possible domination by 'high status' group members as cautioned by Fern (2001). A number

of doctors and senior managers were present in each audience (my 'high status' members) and some from these professional groups volunteered for focus groups. I held a concern that focus group participants might defer to contributions from such members, as they may in their work roles, but in the event this did not happen. Additionally I determined to try to diplomatically avoid any volunteers who I knew from past experience might tend to dominate such a meeting. Interestingly, although staff who possessed such characteristics attended the study mornings, none volunteered to join a focus group.

The focus group environment is likely to encourage much discussion but there may be times when such a forum might restrict input from individuals who wish to contribute against the norm; thus it fell to me as facilitator to encourage all viewpoints, and insist that there were no 'rules'. Participant responses in focus groups have been described as lacking independence, the so called 'n=1' argument (Fern, 2001), who suggest the effect of the group on individuals may alter the independence of their contribution. An additional criticism is that focus group sample sizes are small and any generalisability is not possible (Fern, 2001). However the aim of these groups was to provide insight; and it would be for the reader to judge the transferability of the focus group outcomes to their own situation.

Analysis of focus group data

Having obtained permission and written consent from all group members, I video-recorded each meeting to facilitate later transcription of the discussions. To transcribe the conversations, I used a combined earpiece and microphone headset and two computers; the earpiece was connected to one computer which replayed the focus group video recording, and the microphone was connected to the second computer on which *Dragon Naturally Speaking 11* voice recognition software was operating. I listened to sections of speech which were of sufficiently short duration for me to hold in working memory, and then repeated each of these into the microphone. This method was necessary because contemporary voice recognition software is unable to accurately transcribe voice recordings from individuals whose voices it has not 'learnt' to interpret. I undertook a simultaneous quality check of the transcribed text as it appeared on the computer screen. This technique enabled me to accurately dictate transcripts and to attribute comments to the appropriate individuals. Reissman (1993) notes that transcription is an excellent way of

familiarising oneself with data, and the process can inform the first stage of analysis (Braun & Clarke, 2006); to this end, if an observation struck me while I undertook the process, I handwrote a short memo to inform later analysis. Finally, I checked each transcript again for accuracy by simultaneously reading and listening to the video recording, and corrected any remaining transcription errors.

Thematic analysis allows a researcher to analyse and report themes or patterns within a data set; in particular, to capture something important in relation to the research questions (Braun & Clarke, 2006). To some degree this methodology quantitised data which was essentially qualitative. Tashakkori & Teddlie (2003, p. 5) define '*quantitised*' data as, '*collected qualitative data types...converted into numerical codes that can be statistically analysed*'. Fern (2001, p. 139) points out that if a researcher culls sets of relevant thoughts and opinions from a transcript, it is '*analogous to assigning a 1 to an acceptable and a 0 to an unacceptable characteristic*'. Thus it may be argued that it is feasible to quantitise qualitative data to some degree, in order to facilitate assimilation of results.

Miles & Huberman (1994) suggest qualitative analysis consists of three concurrent flows of activity; data reduction, data display, and conclusion drawing. In this study I followed their approach, and used a system of coding to reduce the data. Codes may be defined as '*the most basic segment, or element, of the raw data that can be assessed in a meaningful way regarding the phenomenon*' (Boyatzis, 1998, p. 63). Miles & Huberman (1994) recommend the creation of a provisional 'start list' of codes which originate from a combination of the research questions, hypotheses and key variables brought to the study by the researcher. In this study, the start list was relatively short because the literature review in Chapter 3 found only limited data from studies which had investigated the area of visual aid use in lectures, and such reports were frequently limited to whether students 'liked' visual aids they had seen; the content of which was a variable which was frequently minimally described, if at all (Clarke, 2012). An example of a coded section of data is shown in Appendix 13.

Miles & Huberman (1994) recommend looking for patterns at a later stage in the data analysis when such commonalities may become clearer. In the analysis of the four interventions, it became clear as I undertook the process that, although the data essentially depicted clearly defined subject matter, the images used in the Custom-

Graphics intervention had introduced an affective element to the lecture, which was separate from the observation that the images had simply conveyed additional information. For example, the sample extract shown in Appendix 13 from Participant 4 suggested an affective element had been present which was not planned into the lecture, and that this had impacted upon the outcome.

The content of the focus group discussions was relatively uncomplicated, and the data display element of the analytic process was undertaken by the creation of a thematic map. Here individual codes were clustered together as a map in Microsoft PowerPoint, a system which facilitated repositioning the various codes to visually establish associative groupings. The map was then colour coded to clarify clusters.

Finally, the clusters were subsumed into a reduced number of themes which represented the smallest number of themes that I believed could be applied to the data. These are shown in the final thematic map in Appendix 13. The results are presented and discussed in Chapter 9.

6.5 Lecturers main study: Interviews

The methodology utilised in the Lecturers main study was that of individual interviews. This was chosen instead of the survey method used in the Lecturers exploratory study because of the likelihood that answers might require additional probing in order to clarify meaning, and also because the questions concerned areas upon which teachers and lecturers might not often reflect. Additionally, individual interviews offer an opportunity to discuss sensitive issues without being overheard by others (Stokes & Bergin, 2006), and although the topic itself was not intrinsically personal; the level of skill and knowledge reported by an interviewee might be associated with a range of feelings about professionalism and competence.

The interviews were semi-structured in design and based on thirteen questions which inquired into respondents' use of visual aids in their professional practice (see Appendix 14). I chose a semi-structured approach because the most revealing responses in interviews may arise from questions which probe deeply, and often cannot be predicted because of their dependence on the preceding answer (Robson, 2002). Interviews which investigate an area of professional skill or competence nonetheless contain a risk of acquiescence whereby respondents may feel some

pressure to describe their practice in more positive terms than may actually be the case.

My personal choice for the interview settings was face to face in the respondents' own environment because I held concerns that telephone interviews might have a depersonalising effect on the transaction. However, due to diary limitations on the part of participants and myself, 18 of the 31 of the interviews undertaken were conducted by telephone. Bryman (2008) cautions that telephone interviewers cannot observe expressions such as unease on the faces of participants, and this was an element that I anticipated might occur; for example a respondent may feel concern that their professional practice was lacking in some way, but which I might not notice due to the distancing effect of a telephone conversation. To pre-empt this I endeavoured to listen assiduously for any hesitation or indication of discomfort on the part of the telephone interviewees. Counter to this caution, Bryman (2008) suggests that the physical absence of an interviewer may actually make it easier for interviewees to respond to sensitive questions. While this might present a cause for concern in sensitive social research situations, my interviewees were all career professionals, and I hoped they would possess a platform of teaching and life experiences of sufficient strength for them not to feel exposed by discussion of this area of their practice. Nonetheless a doubt remained with regard to whether they would be completely open in describing their practice.

I was careful not to include leading questions in either my scripted outline questions or in the ensuing probing questions, although the fact that I was asking about their professional practice at all could be interpreted as suggesting it might be less than ideal. When I asked whether respondents considered learning styles when creating their visual aids, I implied an acceptance of learning styles, and although it was not my intention to do so, I could not completely avoid leading this question. Kvale (2007) suggests leading questions are a valid device to test the consistency and reliability of a respondent's answers, and although this was not my intention, the mention of learning styles produced a marked response among those who held strong opinions with regard to the place of styles in educational thinking.

Unsolicited research calls are unlikely to be welcomed by busy professionals, and Robson (2002) suggests a good plan is to send a letter before calling. I initially sent

each participant a personalised e-mail invitation that indicated they had been selected on an individual basis, and that I was genuinely interested in their thoughts and opinions. I requested a date and time to suit each lecturer, and all telephone interviews were carried out at agreed times. I anticipated that not everyone invited would be willing to participate, but was rewarded by all 31 teachers and lecturers agreeing to be interviewed. This was particularly gratifying as there was no remuneration available, and the interview could be viewed as potentially revealing with regard to their teaching practice. I anticipated most respondents would opt for a face to face interview and one telephone respondent said she would have much preferred this, but unfortunately it was not possible to arrange (in the event, her interview was as wide ranging and informative as any undertaken in this study).

Oishi (2003) emphasises the importance of explaining the purpose of the interview in advance, so that participants are fully cognisant of the research purpose. In my questioning I tried to establish the depth of participants' understanding about visual aids and learning, but without suggesting it might in any way be inadequate. Kvale (2007) suggest that possible tensions between scientific and ethical responsibilities may arise, and I experienced such a dilemma in my interviews. My pilot interviews indicated that for some teachers a key reason for using visual aids may be to help them during a lecture. In the Lecturers main study this was again observed; yet to pursue this question further to the logical possibility that a respondent may have limited knowledge of how visual aids function might result in discomfort, and I did not believe my research justified a risk of embarrassing any interviewees. In all interviews I strove to communicate with openness and a non-judgemental attitude that I hoped would encourage honesty in return. In the event I was rewarded with a frankness and openness on the part of interviewees that was gratifying.

The data collected in the interviews undertaken in the Lecturers main study was qualitative in nature but not exclusively so; many of the primary questions were of a survey type, and the semi-structured style allowed me to probe further and acquire additional information.

Analysis of interview data

Interview transcription was undertaken with voice recognition software in a similar manner to that of the focus group recordings in the Modalities main study described

above; although unlike the group recordings, for the teachers' and lecturers' interviews I used a voice recorder to replay the source material. In this instance an earpiece was connected to the voice recorder, and a microphone connected to the PC which ran the transcription software. Once I had transcribed all 31 interviews, I printed hard copies and read each transcript again; this process allowed me to further immerse myself in the data.

I analysed the interview transcripts by means of thematic analysis, and as the literature review in Chapter 2 had identified many possible reasons to use visual aids, I created a provisional 'start list' of codes in advance as suggested by Miles & Huberman (1994). As well as reasons to use visual aids identified in the literature review in Chapter 2, I included themes selected from Levin's (1981) list of 'possible functions of pictures in prose'; the consideration of cultural influences in Chapter 4, and from my own experiences and knowledge in this field. For example, beliefs and knowledge based on cognitive theories such as dual-coding theory was coded as *'Lecturer-orientated: Knowledge and application of cognitive theory'*.

Each transcript was entered into NVivo 8 qualitative data analysis software as an individual source. The code start list was also entered into the database, and I commenced coding of the source material from this list. Miles & Huberman (1994) observe that the action of coding is analysis in itself, and the initial coding confirmed a notion that I had formed during the interviews and their subsequent transcription; namely that few of the reasons for utilising visual aids during a lecture identified in Chapter 2 of this thesis were offered, at least not until such a list had been presented at the end. At this juncture I made the decision not to include responses to the list of reasons presented at the end of the interview due to the leading nature of this part of the conversation, and to report on these responses separately.

The method of analysis used in this study was similar to that employed in the Modalities main study described above. Codes were assigned to sections of data, and some elements of transcript were assigned more than one code. A section of transcribed interview data and assigned codes is shown in Appendix 17.

As I undertook the coding process, themes emerged which were not adequately described by the codes contained in the start list; for example, the concept of 'visual learners' and an associated reason to create visual aids in order to meet the

requirements for such a category of students was identified and allocated a newly created code, *Internal influence: Learning styles*. At this point, codes which had not been required, such as those which related to cognitive reasons to use visual aids but which had not arisen in the interviews, were discarded.

Once all the data had been coded in this way, an initial thematic map was created in order to visualise relationships between themes (see Appendix 17). Next I collated the coded sections into extracts headed by specific codes; for example, a single document contained all sections of transcripts that were coded under *Student-orientated: Expectations*, and another for *Student-orientated: Aids to notetaking*. I continued until each code headed a collation of relevant excerpts. Each of these documents was then read carefully to consider whether they formed a pattern, or whether components within them formed a pattern, and a developed thematic map was created (see Appendix 17), and colour coded to illustrate emergent themes; for example, lecturers' reasons to use visual aids were colour-coded green.

For the Lecturers main study, many of the themes were overt, in that they were clearly expressed by interviewees. As the coding continued, a pattern emerged that the reported absence of visual aid training had created a void which appeared to have been filled (at least in part) by other influences, such as VAK theory; thus the theme *Absence of visual aid training in ITT* sits at the centre of the thematic map shown in Appendix 17.

The final outcome of this process was that the codes were reduced to five themes and five sub-themes. A consistent theme was that many lecturers used visual aids primarily for themselves, some said so explicitly; for example '*I make the PowerPoint for me first and then for the audience – I know it sounds terrible, but it's like that!*' (Jane). Others were less explicit in this regard; nonetheless the proportion of coded excerpts which described visual aid use that related primarily to the lecturer's use outweighed those that were student-orientated.

The results of the analysis are presented in Chapter 10.

6.6 Conclusion

This chapter has explained the research methods chosen for the studies undertaken in this thesis. It has outlined the design of the two exploratory studies and the two

main studies undertaken in this thesis. It has provided the rationales underpinning the choice of methods, and described the processes of analysis undertaken.

The next chapter describes the Modalities exploratory study in detail, and presents the results obtained.

Chapter 7 Modalities exploratory study

7.1 Introduction

This chapter explores whether a simple dichotomy of words and images as presented by Levin (1981), is a valid and sufficient differentiation when applied to visual learning support for a lecture. The chapter describes an exploratory study in which differences in perception and recall were examined following lectures which contained identical spoken content, but which were supported by visual aid sets which comprised two different and readily available resources. One lecture showed bulleted text and the alternative version displayed images obtained from an Internet search. Participants' appreciation of the modalities, and their retention and recall of key points after 14 days is discussed. Results from both lectures are compared and analysed, and proposals are made for further enquiry in the Modalities main study.

7.2 The study

In Chapter 2, I described how much of the literature which has investigated the visual medium in a learning context has utilised laboratory-based experiments, and in Chapter 3, I noted that the research literature contains relatively little data with regard to the design and content of visual aids used in lectures. Brunken et al. (2010) suggest research into learning methodology should move toward real life scenarios, and this exploratory study follows this recommendation and utilises a genuine lecture environment. It is hoped that such an approach will add a degree of transferability to my research.

In order to situate the lecture in an authentic lecture environment, I selected a topic which I was able to add to a series of existing in-service training days based on interpersonal communication, and to which I had access due to my role as course facilitator. The content was selected from *Grooming, Gossip and the Evolution of Language* (Dunbar, 2004), and was based on an anthropological view of the evolution of spoken language among humans. The topic was broadly relevant to the day and included contemporary ideas which I believed would not be widely known by many in the sample groups.

Each lecture took place at 10.00am and lasted approximately 15 minutes, and due to the practical nature of the study day, no other visual aids were shown during the remainder of the event. The lecture itself contained 33 key learning points.

When preparing the lecture, I excluded descriptive language, metaphor and evocative adjectives as much as possible because I felt, concomitant with the findings of Johnson & Raye (1981), that the use of such techniques might induce mental imagery which might affect results. However, there was one exception; when I introduced the lecture I began by asking participants to imagine themselves in a scene in which they faced a chimpanzee, and both they and the chimpanzee were holding the hand of their respective mothers (for a transcript see Appendix 1). I began each of the six lectures in this manner, and this mode of introduction was to feature in the results in an unexpected way.

The participants comprised an 'opportunity sample' (Bell, 2005), and were attendees on pre-arranged in-service training days of which the subject was communication and appraisal skills. All were supervisors or managers employed by the NHS, and all had elected to attend the day. Prior to the lectures, I undertook informal conversations with colleagues who were representative of the sample group to ensure the lecture content was not widely known; that it could be readily understood, and that it would be relevant to the in-service training day in which the lecture was delivered. Six lectures were delivered in total, and 77 participants took part in the study; 40 attended the lectures supported by text-based slides, and 37 received the lecture supported by images. The two modalities were then compared for participant recall and preference.

Visual modalities

Each lecture variant was visually supported by a set of 14 slides. These were created using Microsoft PowerPoint 2007, and were displayed by a Sanyo multimedia projector connected to a Dell laptop computer. Each slide was projected for approximately 45 seconds.

I designed the study around two contrasting sets of visual aids to be shown in support of an otherwise identical lecture. Reports of students' experiences in the literature suggest many lecturers rely on text-based slides to provide visual support for their lectures (Adams, 2006; Burke et al., 2009; Young, 2004), and for one of the modalities I chose a 'bulleted' text design described by Kosslyn et al. (2012) as one in relatively common use, and which is illustrated in *Social Research Methods* (3rd

ed) (Bryman, 2008). This layout is available in template form when PowerPoint software is first opened and the option 'new slide' is selected.

The alternative modality was a slide set made up of relevant images, which some writers have suggested are preferred by 'visual' learners (White, 2005; Yates, 2006). An example from each modality is shown in Figure 7.1 (see Appendix 1 for complete sets).

In everyday usage, the two modalities may be combined, either within a visual aid set, or in individual slides which contain both text and an image. However, in order to explore differences in impact, I maintained a clear separation

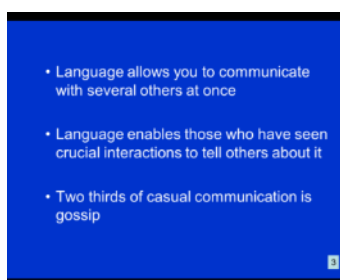


Figure 7.1 Slide 3: *Trad-PPT* (left), *Net-Graphics* (right).

between the modalities; one set comprised text only (including the presentation of numbers as text rather than numerals), and the alternative set contained images only.

Text-based visual aids (Trad-PPT)

The text-based slides were designed to be typical of the genre, and comprised summaries of key points delivered by the lecturer which were displayed concurrently with speech. The popularity of this method led me to apply the moniker 'Traditional PowerPoint', abbreviated hereafter as 'Trad-PPT'. The lecture contained 33 key learning points, each of which were iterated by on-screen text, and each slide contained an average of 3 points. The final three slides displayed pairs of contrasting sentences; the second sentence in each pair was altered to include a more stimulating verb to create heightened attention, a technique known as 'Surprising Broca' (see below). For example, slide 13 displayed a sentence in which the verb 'came' in the first line was replaced with 'limped' in the adapted version:

The waves came in slowly.

The waves limped in.

Trad-PPT slides contained an average of 27 words, and were presented in white Arial 32 pt. text on a plain dark blue background. Both slide sets were correspondingly numbered and each number supported the same section of the script. This ensured

a slide of the same number in the sequence of whichever set was in use was displayed at the same point in the script. Each Trad-PPT slide appeared in full (rather than section by section), in order to simplify linkage of slides to the script. The Trad-PPT slide set required approximately one hour to design and create.

Images (Net-Graphics)

For optimal comparison, I created the same number of slides for the Net-Graphics set as for Trad-PPT. However, images shown during a lecture often illustrate only one point at a time, and by adhering to this practice I restricted the number of images I was able to include to 14. A consequence of this decision was that only 11 of the 33 key learning points which were supported by Trad-PPT were represented in Net-Graphics. The final 3 slides supported the same learning point in each set (see Appendix 1).

Images were obtained from an Internet image search as recommended by Mayer (Atkinson, 2005b). The search engine 'Google' was chosen due to its widespread popularity, and in order to ensure each image would be clearly defined when projected, the search definition was restricted to 'Large'. Key words which related to each section of the lecture were entered into the search field, and a relevant image was selected from the results. The selected images were then copied and pasted directly into blank PowerPoint slides. By its nature, an online image search produces pictures which have a connection to the search word or phrase; as such they tend to simply relate to the topic rather than provide enlightenment. Consequently the chosen images served predominately as a relevant background, and most possessed no specific explanatory or memory-aiding functionality. I named this modality 'Internet Graphics', abbreviated hereafter as 'Net-Graphics'.

I excluded graphs and charts from this study, as their effectiveness when displayed in support of language is well recorded (Tufte, 1983; Vekiri, 2002). Also known as 'logical pictures' (Schnotz, 2001), diagrams bridge the gap between images and language, and their inclusion may have skewed the results in favour of graphics. For the same reason I excluded any form of graphic organiser in this modality.

Slides 12-14 supported examples of stimulating verbs in contrasting sentences as mentioned above. For example, slide 13 contained an image of gentle waves to support the narrative, '*The waves came in slowly*' and '*The waves limped in*' (Figure 7.2).



Figure 7.2 Slide 13: Net-Graphics.

The relevance of Net-Graphics slides to the learning points varied; for example, slide 4 showed a selection of newspapers on a newsagents' shelf to accompany the statement '*popular newspapers devote two-thirds of their space to human interest stories; to gossip*'. As such, the image illustrated an element of the point, namely newspapers, but did not support the point itself.

One Net-Graphics slide was customised. To visually support the concept of increasing attention by the introduction of a stimulating verb to speech, a technique known as 'Surprising Broca' (Williams, 1999), I used Adobe Photoshop to morph an image of the French anatomist Paul Broca into a startled expression as shown in Figure 7.3. The slide advance then created an illusion in which Broca's expression appeared to change to one of surprise.

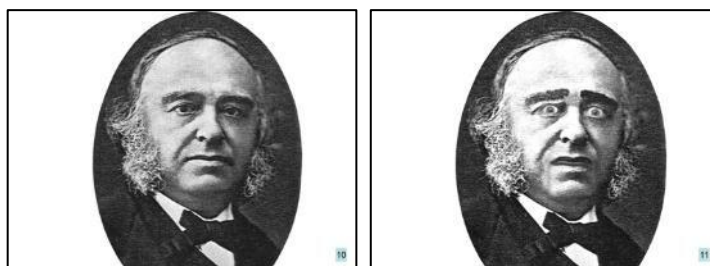


Figure 7.3 Slides 10 & 11: Net-Graphics: 'Surprising Broca'

The Net-Graphics slide set took approximately 90 minutes to create, of which 30 minutes was required to construct Broca's expression on slide 11.

Lecture delivery

Six lectures were delivered; three were supported by each modality. I rehearsed the lecture script beforehand in order to be confident I would be able to deliver the same content in sequence for each lecture without reference to the slides on display. In normal teaching practice I would actively use both speech and gestures to incorporate graphic visual aids whilst speaking. However, I would be much less likely to do so with projected text, because this mode generally stands alone and allows students to read the content at will. I did not wish such differences in technique to skew results by providing Net-Graphics with more import in the lecture,

and to achieve such a separation, I enlisted the support of my co-facilitator. For each lecture, she selected which slide set to show and ensured we used each modality three times. She controlled the slides with the aid of a transcript annotated with slide-advance points. I did not look at the screen at all, and thus did not know which set of slides was utilised in each lecture, and I did not interact with them in any way.

Evaluation

Immediately after each lecture, participants completed an evaluation form (see Appendix 2) which recorded their reactions to the lecture, and to the visual aids. Six questions offered a 5 point Likert scale (1-Poor, 5-Excellent); four questions enquired about the lecture in general terms, and two asked specifically about the visual aids used. An additional space was provided for comments.

Later in the day, the group were informed that they would each receive a further questionnaire in the internal post 10-14 days later. I did not explain that this would test recall, as I did not wish to provide any additional motivation to memorise the material. Two weeks after the lecture, every participant received a questionnaire which contained 14 questions that tested recall of the lecture material (see Appendix 2), and each was accompanied by a return envelope. All questionnaires were anonymous, and colour coded to ensure responses were attributed to the correct visual modality.

To gain further insight into reactions to the lecture, and ability to recall its content, I also interviewed a sample of nine participants individually; four from Trad-PPt groups, and five from Net-Graphics. The interviews were informal and inquired into their reactions to the lecture and their memory of the lecture content.

7.3 Results

Post-lecture evaluation

All participants (n=77) completed the post-lecture questionnaire on the day (Trad-PPt n=40, Net-Graphics n=37). The results are shown in Table 7.1, with modes underlined.

Questions 1, 4, 5 and 6 enquired into participants' reaction to the lecture in general terms, and did not produce noticeably different results between the two modalities.

Questions 2 and 3 asked specifically about the visual aids shown during the lecture, and these received lower scores from Trad-PPt participants; a mode of 3 compared with a mode of 4 for Net-Graphics.

Table 7.1 Immediate post-lecture responses

Trad-PPt	Poor 1	2	3	4	Excellent 5
1. Did you enjoy this lecture?	0	0	9	<u>24</u>	7
2. How would you rate the VAs?	1	12	<u>16</u>	7	4
3. How appropriate were the VAs?	1	7	<u>16</u>	11	5
4. How interesting was the information?	0	0	4	<u>29</u>	7
5. How well was it presented?	0	0	5	<u>25</u>	10
6. How easy was it to understand?	0	0	4	<u>22</u>	14

Net-Graphics	Poor 1	2	3	4	Excellent 5
1. Did you enjoy this lecture?	0	0	7	<u>28</u>	2
2. How would you rate the VAs?	0	0	11	<u>20</u>	6
3. How appropriate were the VAs?	0	0	9	<u>22</u>	6
4. How interesting was the information?	0	1	6	<u>23</u>	7
5. How well was it presented?	0	0	2	<u>25</u>	10
6. How easy was it to understand?	0	0	4	<u>19</u>	14

A dislike of text-heavy slides from some Trad-PPt group members was indicated by their supplementary comments; seven referred to the visual aids in a negative manner, suggesting they '*needed livening up*', were '*a little boring*', '*did not add anything*' and '*pictures or photos might be more stimulating*'. One Net-Graphics respondent commented on the visual aids, and noted they were '*not wholly essential but did focus your interest on what was being said*'.

Recall after 14 days

All participants received postal questionnaires 12 days after the event; from a total of 77 delivered, 54 were returned. 30 were received from Trad-PPt, and 24 from Net-Graphics. This represented an overall response rate of 70% (Trad-PPt 75% and Net Graphics 64%). Correct responses for each question by group are shown in Table

7.2 (for comparison, the relative percentages are shown in blue).

Table 7.2 14 Days post-lecture recall

	Trad-PPt (n=30)		Net-Graphics (n=24)	
	Correct	%	Correct	%
1. When judging sincerity, what is the relationship of body language, voice tone and words?	22	73	17	71
2. What do some scientists believe is the reason behind the evolution of language?	15	50	10	42
3. What is the average social group size for humans?	13	43	9	40
4. What are some possible effects of someone we don't know well standing close to us when communicating?	5	17	11	46
5. What is the social group size for chimpanzees?	9	30	7	29
6. How much of their day do chimpanzees spend grooming?	9	30	7	29
7. Who discovered the area of the brain which analyses meaning?	5	17	0	0
8. What nationality was he?	3	10	4	17
9. What year did he discover this?	2	7	2	8
10. In our casual conversations, how much on average is gossip?	10	33	8	33
11. What is the technique of using strong words to stimulate listeners known as?	1	3	0	0
12. What type of words are they?	6	20	3	12
13. Can you give an example of this technique?	13	43	5	21
14. What is the average number of people we know intimately?	15	50	16	67
	128	30	99	29

An initial visual analysis of Table 7.2 suggests the recall results for Trad-PPt and Net-Graphics were not significantly different overall. This was checked by undertaking a Mann-Whitney U test to compare the numbers of correct answers provided by each of two modality groupings. The results indicated there was no significant difference in the numbers of correct answers provided by those who had experienced the Trad-PPt visual aids, and those who had seen the Net-Graphics version ($U = 357.0$, $z = -0.53$, $p = .958$).

On closer examination of the results shown in Table 7.2, four questions indicate differences in recall between groups which are worthy of further analysis; namely Questions 4, 7, 12 and 13.

Q4: Trad-PPt - 17%, Net-Graphics - 46%

Q7: Trad-PPt - 17%, Net-Graphics - 0%

Q12: Trad-PPt - 20%, Net-Graphics - 12%

Q13: Trad-PPt - 43%, Net-Graphics - 21%

Factors which may contribute to these responses are discussed in section 6.4 below.

Interview results

In the follow up interviews, Trad-PPT interviewees recalled little about the visual aids used, and the following comments are representative of those received,

'I didn't remember that there were any' (with prompting, this interviewee was able to recall *'the blue screens'*).

'I remember white text on blue background, but not what it said'.

'I can remember some pictures and things' (There were no pictures)

'Graphics would have helped'.

Net-Graphics interviewees spoke positively about the visual aids:

'They helped me to remember'.

'The style was helpful, I was able to focus on the picture and listen to the words'.

'Good, helpful'

'I much prefer graphics'

Five interviewees were apologetic for their inability to remember much from the lecture (3 Trad-PPT, 2 Net-Graphics). Of particular interest were the comments of two participants interviewed from the Net-Graphics group, who independently described their memory of a slide which portrayed chimpanzees and people. They were able to describe the scene in some detail and appeared to mentally reconstruct the image when describing this memory. Yet I had shown no such slide; they described the introduction to the lecture in which I asked them to imagine themselves standing opposite a chimpanzee (for more detail, see Appendix 1). This finding is discussed in the following section.

7.4 Discussion

Modality effects

The finding that there were no statistically significant differences between the retention rates of Trad-PPT and Net-Graphics groups suggests the role of both slide sets in aiding recall was similar; this could be because each modality supported the lecture to a similar degree, but may also mean that both were equally ineffective in this function.

As described above, a disparity in the representation of key points existed between the two lecture modes; only 11 key lecture points were supported in Net-Graphics, compared with all 33 in Trad-PPt. The disparity was larger in the 14-day recall questionnaire; for only 4 of the questions had the answers been visually represented by Net Graphics, whilst all were iterated by Trad-PPt. This disparity might have been expected to produce a significant difference in favour of Trad-PPt; yet the Mann-Whitney U test indicated this was not the case.

Moreno & Mayer's (2002) suggestion that text iteration of spoken words can improve recall was not borne out in this study, and the repetition of key lecture points in Trad-PPt which might have been expected to provide a higher rate of recall did not do so. One reason for this finding may be that my physical presence whilst speaking created a split attention effect (Chandler & Sweller, 1991) with the text projected beside me.

Trad-PPt appeared to assist retention of only two points in this study; a proper noun (Broca), and examples of sentences that employed stimulating verbs. This suggests that projected text may be limited in its ability to assist storage of new information in long-term memory, although the presentation of single words or short phrases might aid recall in some circumstances.

The increased levels of learner appreciation recorded for Net-Graphics may be linked to one of Levin's (1981) functions of pictures in prose, namely 'decoration' which increases overall attractiveness (see Table 10.1). Whether an increase in the visual attractiveness of a lecture may produce a benefit to a learner is unclear, as although it was not found to increase retention, respondents expressed a preference for this modality.

Wais et al. (2010) suggest the presentation of images which instigate bottom-up processing may adversely affect top-down retrieval, and it is possible that the images used in Net-Graphics may have interfered with participants' processing of spoken information, instead of assisting as might intuitively be expected. In doing so the images may have imposed an extraneous cognitive load (Sweller et al., 1998). Although the images were relevant to the lecture topic, they were not pedagogically functional, and as such were 'task-inappropriate' (Schnotz & Bannert, 2003). What Joyce (1937) refers to as 'the ineluctable modality of the visible' may have drawn

learners (initially at least) into the image, even though it was not required to support learning.

Variance by individual question

Although differences between Net-Graphics and Trad-PPT results were not statistically significant overall, four questions produced variance in recall scores which suggested the modality difference may have influenced retention, and warrant a closer analysis.

Question 4 asked, 'What are the possible effects of someone we don't know well standing close to us when communicating face to face?' Net-Graphics participants scored 46% correct compared with 17% for Trad-PPT. This may be because slide 9 from Net-Graphics showed an encounter between two people standing close to each other, and who appeared comfortable in such proximity. This positive visual image may have facilitated dual coding (Paivio, 1979) of the concept of two individuals standing close together as a positive experience.

For Question 7, 'Who discovered the area of the brain which analyses meaning?' 17% of the Trad-PPT participants recalled the name 'Broca' in the 14-day questionnaire, and no-one from the Net-Graphics groups. This may be because respondents who answered correctly had dual coded the name '*Broca*', as a result of reading the name on the slide concurrently with hearing it spoken. Because Net-Graphics participants only saw Broca's image, no alternative conduit was provided for his name, and the function of the image was limited to facial recognition only. Although Broca's image was relevant to the topic, it did not support the purpose, which was to store the anatomist's name in long-term memory.

Question 12 asked, 'What type of words are they?' and Question 13, 'Can you give an example of this technique?' The improved retention of information recorded for Trad-PPT over Net-Graphics for these two questions (Trad-PPT 20%, Net-Graphics 12%, and Trad-PPT 43%, Net-Graphics 21% respectively) might be accounted for by Trad-PPT displaying a visual contrast between the pairs of sentences (Slides 12, 13 & 14). By reading the contrasting pairs, Trad-PPT participants may have been able to make a visual comparison whilst also hearing the difference described. The smaller amount of text on the final three slides may have imposed a lower processing demand than denser text contained in Slides 1-11. Additionally, Net-

Graphics provided a visual representation of the sentence subject only, and did not iterate the point regarding replacement of the verb.

Student preference

Post-lecture comments indicated a preference among Trad-PPT for graphic visual aids, and Net-Graphics rated visual aids higher in Questions 2 and 3 than Trad-PPT (see Table 7.1). This finding was supported by interview responses, in which some participants from each modality group stated a preference for images over projected text. It is possible that the responses from Trad-PPT which indicated a preference for images were motivated by a reaction against the text-heavy visuals, rather than a specific desire for pictures. Nonetheless, a positive appraisal of images was not reflected in the recall results for Net-Graphics.

The follow-up interviews supported the notion that neither set of visual aids had been helpful in aiding retention of subject matter. Net-Graphics members were able to recall the content of many of the slides shown; however, despite such a superior recall over Trad-PPT participants, this did not result in improved recall of key lecture points. It is possible the images did not relate sufficiently closely to the lecture content to have aided either comprehension or storage in long-term memory, and were thus task-inappropriate (Schnotz & Bannert, 2003). Had the images been more carefully planned and designed, they may have created an impact on recall.

The provision of an image for learners to look at whilst listening may not be in itself pedagogically functional. The practice may take up limited processing power which would otherwise be available for the creation of internal 'top-down' visual representations which are enlightening, rather than merely 'about' the lecture topic (Kosslyn, 2007b). According to dual coding theory (Paivio & Csapo, 1973), images presented in association with words result in information being dual coded, however in this instance dual coding may not have taken place due to presentation of images which were relevant to the topic but not the learning points.

The 'Surprising Broca' pair of slides did not assist comprehension or recall of the concept of stimulation of Broca's area by means of adding an unexpected verb, and failed to act as a mnemonic device to aid storage of the name, possibly because it visually associated the act of surprise with the eponymous anatomist rather than the area of the brain to which it related. A more purposeful representation might have

been a cartoon depiction of the brain, in which Broca's area itself wore a surprised expression. A lack of a coherent linkage between Net-Graphics images and speech may have been exacerbated because links were not provided by the lecturer, and participants seemed not to have made their own, as cautioned by Weidenmann (1989) and Schnotz (2001).

Participants, who were shown images of beaches whilst listening to an example of increased attention brought about by the use of a stimulating verb, may have had their visual working memory distracted by the presentation of an image related to the subject of the sentence, but not the concept of which it purported to show an example. In this way the slides may have been less effective than no image at all. Trad-PPt slides contained the verb itself, and the contrasting sentences were available on the screen for direct comparison.

By following the advice of Mayer (Atkinson, 2005b), the practice of selecting Internet images to populate the Net-Graphics slide set also appears to meet the recommendation of Dunn & Dunn (1993) to satisfy the preference of 'visual learners'. Yet images produced no significant difference in recall; and although no styles or preference analysis was carried out, the comments of participants suggest that had such an analysis been undertaken, at least some of the 77 participants might have indicated a preference for visual representations. As discussed in Chapter 2, it may be that a predisposition of visualisers to think in images is interfered with by the presentation of renditions which are relevant but not purposeful (Schnotz & Bannert, 2003).

Lecturer style

By choosing not to interact with the visual aids, I may have removed a factor upon which the effectiveness of images may depend. Lecturers who display an image often refer directly to the content, and interact with it by gesture and spoken reference in a way that does not commonly take place with text-based slides. For example, when explaining a 3:1 difference between the social group sizes of humans and chimpanzees supported by Net-Graphics slide 6 (see Figure 7.4), I would ordinarily direct learners' attention to a similarity between



Figure 7.4 Slide 6: *Net-Graphics*.

the 3:1 ratio between cranium size in humans and chimpanzees, and a similar ratio in human-chimpanzee social group sizes. In the lecture I made no reference to the picture; instead I left it to act simply as a relevant decoration, and allowed the learners to make their own connection. This lack of interaction may have resulted in an under-utilisation of the graphic slides by participants as cautioned by Weidenman (1989). I may thus have tried too hard to avoid personal bias with Net-Graphics; whereas the Trad-PPt slides appeared at appropriate points in the discourse and my lack of interaction may simply have replicated normal practice for this modality.

The Net-Graphics results support the findings of Mayer & Gallini (1990) that illustrations which are representative of a topic, but not specifically designed to aid understanding do not aid learning. The limited impact of images led me to conclude that, in order to be effective in a lecture environment, images should be created with a specific pedagogic purpose, and I decided to pursue this area further by using a carefully designed set of images in the Modalities main study.

The sequence in which representations are delivered may also have an impact on learners (Ainsworth, 2006). In this study, the visual aids were introduced as I commenced each associated point in accordance with common practice; this also ensured that the preceding slide did not remain on view whilst I introduced a new element. Learners were thus presented with two sources of information simultaneously. It is possible that text slides may be of greatest benefit to learners if they are introduced as a summary after each point has been made, and learners are then allowed a period of silence in which to read and consolidate the content.

Redundancy

Trad-PPt did not produce any significant impact on recall. This finding did not support the dual processing theory as applied to simultaneous processing of text and speech proposed by Mayer (2005b), as there was no evidence that concurrent presentation of text and speech produced any improvement in recall over relevant but non-functional images. As discussed in Chapter 2, according to the Integrated Model of Text and Picture Comprehension (ITPC) (Schnitz, 2005), the display of redundant text may have engaged visual working memory which might otherwise have been available for image processing. Similarly, the display of relevant but non-functional images in Net-Graphics may also have created a general redundancy

effect (Schnotz, 2005) in which the display of images interfered with participants' ability to create their own mental images. If so, this may have created an expertise reversal effect (Kalyuga et al., 2003), as although participants were not literally experts in the lecture topic, they were capable of imagining all the components required to create the concepts, as evidenced by those who described a scene which had not been shown.

The visual rendition of the name 'Broca' may have assisted recall. Similarly, the textual iteration of short sentences in Slides 12-14 may have contributed to retention. This finding warrants further consideration of the minimalist 'Lessig' method (Reynolds, 2005a) described in Chapter 2 as a viable visual modality. It is possible that the presentation of such minimalist text may take up less visual working memory capacity than text-heavy summaries, and thus permit top-down imagery to be engaged in simultaneous with listening; whereas the more dense Trad-PPT design may interfere with visual processing. This is an area which requires further research, and is included in the Modalities main study.

Questionnaire response rate

The response rate for 14-day questionnaires was 70%, which was higher than the average for organisational survey returns of 53% found by Baruch & Holtom (2008) in their meta-analysis. However, I knew many of the participants personally and had also established a relationship with them in the course of the study day, so I anticipated a higher response rate than 70%, particularly in view of their expressed agreement given on the day to complete the questionnaires when they were received.

A possible explanation for the lower than anticipated response rate, may be that despite the assured anonymity, some participants felt they had remembered insufficient detail to justify completion and return of the questionnaire. This notion was supported by the emphatic apologies provided by five of the nine interviewees for their inability to recall as much information as they would have liked. They appeared to feel they had let me down in some way. Robson (2002, p. 69) cautions against *'inducing participants to commit acts diminishing their self-esteem'* and it may be that the recall tasks had this effect on a small number of participants, and resulted in some not wishing to return questionnaires which contained only a small

number of correct answers. Even though I had reiterated to all participants that the questionnaires were for research only and that individual scores were not important, self-esteem may have been a factor.

The additional information provided by the nine interviews undertaken in this exploratory study suggested that face to face conversations might provide a greater degree of insight for the Modalities main study than questionnaires alone; particularly as the lecture topic was intended to be more abstract and may thus prove more difficult for participants to recall.

Memory of an unseen slide

Two interview participants recalled an image which had not been displayed, and must therefore have been constructed internally. This finding adds to those of Johnson & Raye (1981) and Dallet & Wilcox (1968) who recorded subjects' ability to recall images of scenes about which they had only read, but which they believed they had seen in a photograph. In my study the respondents had listened to a description of a scene which involved chimpanzees and people which they later recalled as a seen image, and this suggests the same effect may be achieved with imagery which has been initiated by speech. The vividness of the memory reported by these participants indicated that for them, I added a visual modality to the lecture. This finding suggests that the stimulation of an internally created or 'top-down' image might be of benefit when teaching topics difficult to depict on a screen.

7.5 Recommendations for the main study

A lack of impact created by text summaries in Trad-PPT, coupled with the suggestion that small amounts of relevant text may assist recall, suggest the display of a minimalist style of text may have a value during a lecture. Its inclusion as a discrete modality in the Modalities main study may provide useful data, particularly as this technique does not currently feature in the research literature.

The images obtained from simple Internet image searches did not produce a significant impact; thus in the Modalities main study it may prove more insightful to display images which have been carefully designed to support the key points. Additionally the lecturer should interact with images as appropriate, in order to undertake the investigation in accordance with common practice, and thus increase transferability.

The results of this exploratory study suggest that the categorisation of visual aids as a duality of either text in bullet-pointed form, or images which are relevant but not pedagogically purposeful, may be a false dichotomy; as variations within each modality might be utilised which create a greater impact upon learners. Although a lack of impact was recorded for text summaries in this exploratory study, its ubiquity suggests this modality should be retained for further investigation in the main study.

7.6 Conclusion

This chapter has described an exploratory study, which compared the effects on recall and preference of two identical lectures which differed only in the modality of visual aids shown. It has outlined the rationale for the selection of visual content, described the process undertaken, and presented and analysed the results. The chapter records that no significant difference in recall was found between text-based and graphic-based visual aids. It concludes traditional text summaries and images obtained from a simple Internet search may both be of limited assistance to students in aiding the transfer of information to long-term memory. The chapter showed that, although participants expressed a preference for images as visual aids, this appreciation was not reflected in recall results.

The chapter concludes that image-based visual aids which have been carefully designed should form part of the main study rather than those selected from an Internet search, and that interaction between lecturer and visual aids should be included. The display of brief text summaries and the deliberate instigation of imagery should also be considered for further study. Additional insight obtained from informal interviews undertaken with a sample of participants suggests a mixed qualitative and quantitative enquiry may produce richer data than a quantitative instrument alone.

The next chapter explores lecturers' knowledge in the area of visual aid use.

Chapter 8 Lecturers exploratory study

8.1 Introduction

This chapter continues the investigation into visual aid use in post-compulsory education and inquires into lecturers' knowledge and practice with regard to the visual support they provide for their learners. The chapter outlines the design and administration of a quantitative instrument to 64 teachers and lecturers employed in post-compulsory education. Results are presented and discussed, and comparisons are explored between lecturers and students engaged in HE and those employed in work-based teaching roles. Responses are also compared between those in possession of a teaching qualification and respondents employed in a teaching role but without a qualification. Conclusions are drawn with a view to informing the design of the Lecturers main study.

8.2 The survey instrument

As noted in Chapter 3, the literature contains little data which relates to the manner in which lecturers design and use visual aids in their lectures; researchers have frequently limited their investigations to the modality, and in particular whether or not lecturers used PowerPoint to create and display their visual aids. This exploratory study seeks to reduce the lacuna, and also to provide a foundation for the Lecturers main study of this thesis.

I designed a questionnaire to address the following questions:

- What beliefs do teachers and lecturers hold with regard to visual aids?
- What knowledge do they have about the design and application of visual aids?
- What skills have they developed through their experiences with visual aids?
- What differences in knowledge and experience exist between qualified and unqualified teachers, and between those who are employed in HE and those who are work-based?

The questionnaire was divided into sections which relate to the above questions (see Appendix 3), and the design and rationale is described in detail below. In the absence of data which relates to lecturers' knowledge, many of the questions in this instrument were informed by my personal experiences with ITT students.

Section A: Beliefs

Although a dearth of detail exists in the literature concerning visual aid design, comments from students suggest many lecturers predominately use visual aids which comprise a textual summary of their spoken delivery (Burke et al., 2009; Yilmazel-Sahin, 2009; Young, 2004). This survey instrument inquired into the extent to which text-based visual aids are used among the sample group; whether lecturers use text because they believe in its efficacy as a visual aid (Questions 7, 9, 10); whether they believe images to be appropriate (Questions 2, 3, 4, 5), or if they display text because resource or knowledge limitations are a factor (Questions 23, 24, 25).

Question 2 was drawn from the suggestions of Sless (1981) and Kress & Van Leeuwen (2006) that pictures may be regarded as more appropriate to the learning needs of children than of adults. Questions 4 and 6 inquired into respondents' belief in relation to 'visual learners' (Dunn & Dunn, 1993; Fleming & Mills, 1992). In Chapter 2, I noted the influence of VAK theory among trainee primary teachers (Sharp et al., 2008), and I sought to find out if this theory also prevails among post-compulsory teachers and lecturers.

Question 8 asked whether lecturers agreed that a well-told story could create images in the minds of learners as effectively as images which are projected, and was formed from three influences; the first is personal experience of sharing clinical experiences with students in which I sometimes found myself believing I had been an actor in the stories of a colleague; secondly, the findings of Johnson & Raye (1981) in which the memories of participants who had only read about a scene, became confused with visual percepts, and thirdly, the experience reported by two respondents in the Modalities exploratory study reported in Chapter 7, in which they recalled seeing a projected image which had in fact only been described verbally.

Section B: Knowledge

In Chapter 3 it was noted that little is recorded in the literature regarding lecturers' knowledge of visual aid design and use. This section was also informed by my experiences with ITT students, many of whom describe how they are often at a loss to know what to include in their visual aids. Although I teach these subjects, none of the respondents in this study had previously attended any of my lectures or courses.

Section C: Experience

Questions in this section were generated from past experiences of discussions with students and colleagues which related to development of their lessons and lectures. Drever (1995) recommends asking one or two colleagues to test questions by 'shredding' questions and asking them to imagine how a respondent might react and interpret them. Three colleagues 'shredded' the questions with me in this way, and apart from recommending some grammatical changes they agreed the questions were appropriate and readily understandable.

Section D: Qualifications and teaching environment

Two questions enquired into the highest level of teaching qualification held by respondents, and whether they were primarily employed in an educational establishment or in a work-based learning capacity. For the purposes of this exploratory study, HE lecturers and ITT students were combined. I made this decision on the basis that the activities of both groups are subject to academic scrutiny; by inspection and peer review for lecturers, and by academic and practical assessment for ITT students. Conversely, the NHS work-based trainers involved in this study are largely autonomous as far as teaching activities are concerned, and no measurement or inspection process is applied beyond post-lecture evaluations or so-called 'happy sheets' (Sitzmann, Brown, Casper, & Zimmerman, 2008).

Pilot

I piloted the questionnaire with five professional teachers who were also colleagues. I wished to know whether they found any of the questions ambiguous, confusing or difficult to understand, and in particular I sought to establish whether any of the questions made them feel uncomfortable, or appeared to question their professional ability or status. This was an area of concern for me because I wished to encourage honesty in the responses, but did not want to cause any discomfort. The questionnaire is shown in Appendix 3.

Administration

Before I administered the questionnaire I contacted every participant to ask if they would be happy to participate in the study; I believed such personalised contact would encourage participation and produce a higher response rate. The methods used to achieve this were:

- a. For respondents I was able to meet face to face, a questionnaire was administered following an explanation and verbal agreement.
- b. For participants I was unable to meet, I initiated contact by either telephone or e-mail, and the questionnaire was sent by post with a return envelope included.

Instructions were included on the questionnaire cover sheet and at the head of each page, and I added further guidance that if respondents were uncertain about which response to select, they should choose the answer they felt was closest.

Questionnaires were administered to 64 teachers and lecturers involved in post-16 education. The group comprised an opportunity sample (Bell, 2005) in that they were easily accessible to me, and were not necessarily representative of a cross-section of the post-compulsory teaching community.

8.3 Results

50 completed questionnaires were received representing a 78% response rate; 7 were received from HE lecturers, 18 from students undertaking ITT, and 25 from work-based trainers. The results are shown below.

Beliefs

Results for beliefs regarding visual aids and their use are shown in Table 8.1, with modes underlined.

Table 8.1 Beliefs about visual aids

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Using VAs usually improves my teaching	<u>30</u>	16	3	1	0
2. Pictures as VAs help children more than adults	3	4	8	<u>35</u>	0
3. VAs support some subjects better than others	9	<u>21</u>	5	13	2
4. VAs help some types of learners better than others	12	<u>33</u>	3	2	0
5. VAs are of little help for some subjects	3	9	14	<u>20</u>	4
6. VAs are of most help to visual learning preference	13	<u>21</u>	7	9	0
7. VAs with text-only are almost always useful	0	8	<u>17</u>	14	11
8. Well told stories create images as effectively as VAs	18	<u>23</u>	5	4	0
9. Text VAs improve my teaching	2	<u>20</u>	12	8	8
10. Text VAs can support any topic I teach	3	<u>23</u>	14	6	4
11. Learners would benefit if I knew more about VAs	15	<u>26</u>	3	5	1
12. When I learn VAs help me	20	<u>24</u>	3	3	0
13. It is difficult to support abstract without text	3	12	14	<u>18</u>	3
14. I know as much as I need about VAs	1	5	6	<u>28</u>	10
15. I believe some teachers use VAs as decoration	7	<u>26</u>	12	4	1

Knowledge

Table 8.2 General knowledge of visual aids

	Correct	% Correct
16. Interactive whiteboard is so named because	19	38
17. Min pixel ht. for an image in PPT full screen	0	0
18. % of learners who are colour blind	9	18
19. VAs increase capacity of which memory	5	10
20. Relative speed of reading to speaking	8	16

Experience

Table 8.3 Lecturers' experiences

	Often	Occas	Rarely	Never
21. I have been complimented about my VAs	10	27	6	7
	Yes	No		
22. I am sometimes at a loss to know how to create a VA	26	24		
23. I sometimes use text because I can't think of a graphic	28	22		
24. I use text because of time	13	37		
25. I use text because that's all I know how	2	48		
26. I have inserted images into PPT	49	1		
27. I have used video in PPT	16	34		
28. I have made non-text VAs to support abstract	30	20		
29. I would like to know more about VAs for abstract	42	8		
30. I have used software which allowed 3D images	5	45		

Comparison by qualification

For the purposes of this comparison, I classified those with a Certificate in Education (Cert Ed) or Post Graduate Certificate in Education (PGCE) as qualified, and those currently undertaking ITT as unqualified because all were in their first year of training. By this classification 22 respondents possessed a teaching qualification, and 27 had none (one did not respond to this question).

Knowledge scores for Questions 16-20 for qualified and unqualified teachers were

compared by carrying out a Mann-Whitney U test (note: Question 17 was excluded because no correct answers were received for this question), and the results are shown in Table 8.4 below. As can be seen Table 8.4, significance levels for this comparison were all above .05 for each which indicated that knowledge for these four questions was not significantly greater for qualified teachers and lecturers than for those with no qualification.

Table 8.4 Responses to knowledge questions according to qualification

Question	<i>U</i>	<i>z</i>	<i>p</i>
16. Name of IWB originates from	285.5	-.274	.784
18. Colour blindness in population	296.0	-.030	.976
19. Which element of memory	293.5	-.116	.908
20. Speed of reading vs speech	262.5	-1.083	.279

Comparison by environment

Knowledge scores for Questions 16-20 were then compared for teachers employed in work-based environments with those employed in universities, and a Mann-Whitney U test was undertaken. The results are shown in Table 8.5; which indicates that for these knowledge questions, there were no differences between University-based lecturers and work-based teachers.

Table 8.5 Responses to knowledge questions according to teaching environment

Question	<i>U</i>	<i>z</i>	<i>p</i>
16. Name of IWB originates from	272.5	-.063	.950
18. Colour blindness in population	269.0	-1.96	.844
19. Which element of memory	234.5	-1.40	.162
20. Speed of reading vs speech	234.0	-1.34	.179

8.4 Discussion

My initial concern that the use of Likert scales which contained a neutral mid-point might produce a high number of neutral responses did not materialise, and the variety and spread of responses to questions 1-15 (Table 8.1) indicates that neither the neutral option nor the ends of the scales were selected to a disproportionate extent.

A) Beliefs

Although 44% agreed or strongly agreed that text-based PowerPoint improved their teaching (Question 9), and 52% agreed or strongly agreed text-based PowerPoint could support any topic they taught (Question 10); 32% disagreed or strongly disagreed, and 24% were neutral. This indicates that even if text-based visuals do dominate in some areas of education, not everyone in this sample believed this modality to be the optimum.

Although participants from both groups teach on a professional basis, the FE and HE lecturers who participated in this study taught students who were working toward formal assessments, while the work-based trainers were all NHS based, and for the most part are engaged in the delivery of stand-alone skills lectures of a didactic nature. HE lecturers might be expected to make greater use of text-based visual aids because of their value to students as aids for future revision (Burke et al., 2009). However it may also be that work-based teachers feel they are able to offer more content by the addition of comprehensive text summaries to their lectures.

Interestingly, although 56% agreed with the statement '*I sometimes use text visual aids because I can't think of a graphic way to illustrate my topic*' (Question 23), only 4% agreed they use text because '*they are all I know how to create*' (Question 25). This suggests that almost all respondents knew how to create a graphic slide (only one answered this question negatively), yet they did not feel a similar level of confidence in their ability to create or source the content. This finding may be attributable in part to the relative ease with which it is possible to teach oneself to insert an image into a PowerPoint or Keynote slide, even though, as indicated in Chapter 2, there is a dearth of guidance for creating an image based in pedagogy.

82% of respondents either 'agreed' or 'strongly agreed' with the statement 'A well told story can create images in learners' minds as effectively as projected images', and this response supported the notion that imagery should form part of the main study.

B) Knowledge

It can be seen from Table 8.2 that the number of correct answers provided for Section B was low. Although 98% of respondents replied they had successfully inserted images into a PowerPoint presentation, no-one selected the correct answer

for Question 17, which asked the minimum pixel height required for a graphic to be sharp when full-size in PowerPoint. This information is not contained in the 'help' facility of PowerPoint, and the low number of correct responses suggests many participants may have received limited guidance in the use of image-based digital visual aids. There were no significant differences found between those with a teaching qualification and those without in this section.

It should be noted that two of the knowledge-based questions concerned relatively modern technology introduced since the last decade of the 20th century, and some of the respondents may have undertaken their ITT before this time. However, the remaining questions which related to colour blindness (Question 18), working memory (Question 19), and reading speed (Question 20) did not include time-related factors, yet also produced a low number of correct responses (10%, 18% and 16% correct respectively). In view of the fact that most classrooms and lecture theatres contain teaching aids which display a variety of colours such as white boards and coloured pens, data projectors which can display a range of media, and interactive whiteboards boards; the finding that only 18% of respondents correctly identified the proportion of the population with colour blindness was unexpected. Colour blindness has been known about since Dalton wrote about his own experiences at the end of 18th century (Dalton, 1798), yet it has been referred to as the 'unrecognised SEN' in education (Albany-Ward, 2010), and it is surprising to find this deficiency might also be unrecognised amongst some post-compulsory educators. These findings suggest further inquiry into the visual aid training received by teachers and lecturers during their ITT may prove insightful, and this is included in the Lecturers main study.

C) Experiences

52% of respondents agreed they were sometimes at a loss to know how to create visual aids that relate to their topic (Question 22), and 56% indicated they sometimes use text because they are unable to think of a graphic way to represent their topic (Question 23). 26% responded that their use of text may be due to time limitations when preparing a lecture or lesson (Question 24). Question 29 offered the statement, 'I would like to know more about visual representation of abstract concepts', and 84% replied affirmatively, while only 10% felt they knew as much as they needed.

On reflection, the statement which comprised Question 15 might have been worded differently; instead of 'I believe some teachers use visual aids as decoration' I might have better worded the question as, '*I believe some teachers' visual aids act primarily as decoration*', and in this way altered the emphasis to suggest that despite the best of intentions, this is sometimes the effect. Nonetheless, 66% agreed with the statement as it was presented.

D) Qualifications and employment

No significant differences were found between responses from those who possessed a formal teaching qualification and those who did not. Although the section contained only five knowledge-based questions, similarities in levels of knowledge were found between groups, and this reinforces the notion that guidance received during ITT and in-service training with regard to the use of visual aids may be small. Whilst I had not hypothesised any specific differences, this was an unexpected finding, as one might anticipate that even if visual aid usage had not been included in ITT, other pedagogical and related knowledge might have informed this area of expertise.

90% responded that they agreed or strongly agreed that visual aids benefit some types of learners more than others (Question 4), and 68% indicated they felt VAs were of most help to learners with a visual learning preference (Question 6). These results suggest that in addition to its presence among some primary teachers (Sharp et al., 2008), VAK may have entered into received knowledge among some post-compulsory teachers and lecturers. As noted in Chapter 2, VAK theory is included some ITT syllabuses, and although the questionnaires used in this study were anonymous, 22 were administered to individuals who were either teaching or undertaking ITT with the University of Plymouth, which includes VARK theory in its ITT syllabus (Exley et al., 2011).

There are limitations to the transferability of results from this exploratory study due to the opportunity nature of the sample. One might have expected the ITT lecturers and students to have greater knowledge than work-based teachers, due to their closer engagement with theories of teaching and learning, yet no significant differences were found. This raises a question about what is taught with regard to visual aid design and use in post-compulsory ITT, and warrants further investigation.

This quantitative instrument raised many questions, and achieved its aim of highlighting areas worthy of further exploration in the main study. The results suggest further insight might be acquired by undertaking interviews with lecturers in order to explore their knowledge and experience in this area more deeply than possible with a questionnaire. This method would also offer an opportunity to address a potentially sensitive area in relation to the amount of training received in the design and use of visual aids.

8.5 Conclusion

This chapter has described an exploratory study in which a quantitative survey instrument was administered to teachers and lecturers to inquire into their knowledge and experience with regard to their visual aid use. It describes how, for the sample of teaching professionals chosen, knowledge of visual aid design and application was found to be limited. No significant differences were identified between qualified and unqualified teachers in visual aid knowledge and use, or between those of HE-based and work-based educators. Proposals are made for a qualitative study which investigates lecturers' practice.

The next chapter describes the Modalities main study in which a comparison of case studies of visual aid application is undertaken.

Chapter 9 Modalities main study: A comparison of four interventions

9.1 Introduction

This chapter presents a comparison of case studies in which four lectures with similar spoken content were supported by different visual modalities; each of which are readily available to teachers and lecturers. Three were projected as visual images, and a fourth stimulated imagery on the part of the learners. The results are presented by modality, and then analysed by three characteristics; recall of key statements; appreciation of modality, and engagement with the topic. The chapter discusses how these contrasting visual aid formats might aid teachers and lecturers, and in particular it examines what benefit a 40-60 word text summary might provide for learners. Recommendations are made as to how lecturers might optimise their use of visual media in teaching environments.

9.2 Research Design

This study is based on the provision of four different modalities of visual support for a lecture. The lectures were delivered to a mixed audience of NHS staff, and were set in a morning of mandatory training (for a programme of the event see Appendix 5). The study days, of which the lectures form part, take place every two weeks, and in order to enlist a sufficient number of participants, each of the four modes was delivered twice. The study design was informed by the undertaking of three pilot studies; following which, eight lectures were delivered over a period of four months.

Because much post-compulsory teaching contains abstract content, I sought a topic which was relatively abstract in content to aid transferability. Additionally, I required a topic which was requisite learning for my employing organisation because the participants available to me were on paid duty. To this end, I selected a series of five organisational 'Values' which are regarded as essential for all staff to know and to embody in the course of their everyday work. The Values comprise five aspirational statements (see Table 9.1); each of which is accompanied by a 50-60 word summary (for full description see Appendix 4). Although the summaries provide extra detail, they do not offer examples of how the Values might manifest themselves in practice.

The Value statements were devised and agreed at a senior level 18 months prior to the study but had been poorly disseminated, and from previous informal conversations at these events I discovered that virtually no staff were able to recite or describe them, and most were not aware of their existence.

Table 9.1. The 'Organisational Values'

- | |
|---|
| V1. Put Patients First
V2. Our Staff Make the Difference
V3. Leaders that Lead and Listen
V4. Pull Together as One Team
V5. Strive for the Best |
|---|

Although the subject was relevant to participants and of benefit to the organisation, it contained no direct motivation to learn and there was no associated test or examination, as such my topic presented no clear benefit to participants. I chose a subject with minimal intrinsic motivation because I believed the absence of such a factor would highlight the impact of the modalities used. As the values were relatively abstract in nature, their depiction in textual form was straightforward, but visual representation required careful design.

The desired outcome of the lecture was that participants should be able to recall the five organisational Values using key words from each of the statements, and that they should be motivated to align themselves with the values when thinking about their role in the organisation.

The four modalities

The lectures were visually supported in four different ways in order to explore the respective merits of each method (see Appendices 6-9). Three of the four variants comprised PowerPoint slides, and a fourth variant involved imagery stimulated by spoken instruction. The visual modalities were:

- **Custom-made Graphics (Custom-Graphics)** Five slides were created from photographs taken within the hospital, and which featured local staff.
- **Traditional PowerPoint (Trad-PPT)** Five text-based slides contained comprehensive information in bulleted form.
- **Minimalist PowerPoint (Min-PPT)** Five text-based slides contained a maximum of five words per slide, and were presented in a large font.

- **Guided Imagery (Guided-Imagery)** Learners were instructed to imagine five separate scenes which represented a manifestation of each Value. No images or text were projected in this modality.

Slide animation in which visual elements are introduced individually, was not employed, and all transitions between slides were undertaken using the option 'fade smoothly'. The slides are displayed in Appendices 6-8, and a summary of the instructions for Guided-Imagery is contained in Appendix 9. For each modality, the Values statement was verbally enunciated twice; at the commencement of the respective lecture section, and again at the end.

The impact on participants was analysed in three ways; accuracy of recall of the Value statements; appreciation of visual modality and engagement with the topic. After each of the eight lectures, group recall was tested and their appreciation of the visual aids recorded. Additionally a focus group was convened 90 minutes later to discuss experiences and reactions to the visual aids. Data was analysed quantitatively and qualitatively.

I chose not to include a mode in which no visual aid or imagery was utilised, because I have observed that when lecturers are faced with no visual aids due to equipment failure, some instinctively compensate by the employment of additional descriptive speech and the placement of additional emphasis on key points which would otherwise have been iterated by text. In this comparison of cases, the option of no visual aid was supplanted by the use of guided imagery which contained no projected image, and to a lesser extent by the minimalist text variant.

The lectures were delivered in a 77 seat lecture theatre and slides were displayed by a Dell Windows desktop computer connected to a ceiling-mounted Sanyo digital projector. Slide sets were created in PowerPoint 2007 and were displayed on a 4m x 3m screen at the front of the lecture theatre. The visual modalities are described in detail below.

Custom-made graphics (Custom-Graphics)



Figure 9.1 Slides shown as *Custom-Graphics*

In the Modalities exploratory study described in Chapter 7, I found that images obtained from a simple Internet search may create only limited impact on recall, so in this study I chose to display graphics which had been carefully created to support the lecture topic. When planning the slides, I undertook many Internet image searches in an attempt to find suitable images, yet despite the prevalence of organised healthcare in the developed world, and images available on the Internet being counted in their millions (in 2011 Flickr alone hosted 6 billion images (Olivarez-Giles, 2011)), these searches produced no results that approached my requirements.

I decided to take my own photographs at the hospital in which I was to deliver the lectures. The graphics modality comprised slides made from such photographs, and the familiarity of recognisable faces was to prove a significant factor in the impact on learners (see Figure 9.1, for larger depiction see Appendix 6).

- Slide 1 depicted a patient's-eye view, from lying in a bed looking up at a doctor and nurse (*Put Patients First*)
- Slide 2 comprised a collage of staff pictured in happy, relaxed poses whilst carrying out their duties (*Our Staff Make the Difference*)
- Slide 3 depicted a Ward Sister leading a cardiac arrest team, and an inset area showed the Sister listening to staff (*Leaders that Lead and Listen*)
- Slide 4 provided a visual metaphor for 'pulling together', and depicted a team of staff pulling on a line of knotted sheets as though in a tug-of-war (*Pull Together as One Team*)
- Slide 5 comprised a collage of staff who were interacting with patients, combined with images of well-known medals and trophies (*Strive for the Best*)

This lecture required approximately three working days to create, and directly involved 31 people who appeared in the photographs. The difference in preparation

time between graphics and text slides was notably much greater than the '50%' additional preparation time suggested by Bartsch & Cobern (2003), or the creation time to lecture time ratio of 3-1 recommended by Chiddick et al. (1997). This was partly due to the number of images required; 19 separate photographs were taken in a busy hospital environment, and included the creation of a simulated cardiac arrest with mock patient, team and equipment. No text was included in this modality. Photographs were inserted as JPEG digital images with a minimum height of 800 pixels to ensure clarity when projected.

Although such a level of preparation was demanding, this should be seen in the context that the most effective slide set was to be adopted for continued use after the study, and be seen by in excess of 2000 staff (as was the case), among whom it aimed to create a lasting affective impact.

'Traditional' PowerPoint (Trad-PPT)

<p>Put Patients First</p> <ul style="list-style-type: none"> • In everything we do, we will view our actions from the perspective of a patient. • Patient care is at the centre of all we do as individuals and as a hospital. • If there is anything reasonable we can do to make each patient's experience better, we will do it. 	<p>Our Staff Make the Difference</p> <ul style="list-style-type: none"> • Great staff are key to delivering the best patient care. • We will be clear about responsibility. • We will provide the support to ensure staff can take every opportunity to improve their skills. • We recognise that every person is different and will ensure that everyone is treated with dignity and respect. • Every member of our staff can make a difference. 	<p>Leaders that Lead and Listen</p> <ul style="list-style-type: none"> • The best patient centred care happens where there is clear leadership and an openness to learn. • We will ensure that there is clinical involvement in our decision making. • We will encourage openness and honesty, and emphasise the importance of feedback. • As leaders we look to learn and improve, not blame. 	<p>Pull Together as One Team</p> <ul style="list-style-type: none"> • The best patient care depends on great teamwork with all team members fully playing their part. • We know teamwork makes for better care for our patients and a better working environment. • We will work closely with our colleagues, our patients, our healthcare partners and the community to deliver the best patient care. 	<p>Strive for the best</p> <ul style="list-style-type: none"> • The best patient centred care comes from excellence becoming the standard. • We want to continuously improve. • We will create flexibility for innovation. • We will add value and make the best use of our limited resources. • We want the care we offer to be the very best.
Value 1	Value 2	Value 3	Value 4	Value 5

Figure 9.2 Slides shown as *Trad-PPT*

This variant, shown in Figure 9.2 (for larger depiction see Appendix 7) was designed to be representative of text based visual aids in frequent usage which offer redundant text as a summary of the lecturer's words based on the Microsoft PowerPoint template (Kosslyn et al., 2012). The Value statement formed the slide heading and the explanatory paragraph was divided into bulleted points below. Each slide contained between 50 and 64 words. This presentation took 30 minutes to create and I was able to copy the text from an existing document, which then required only to be reformatted to a suitable projection size. The heading was black Calibri 44pt, and body text was black Calibri 28pt on a white background. No images were included.

Minimalist text (Min-PPt)

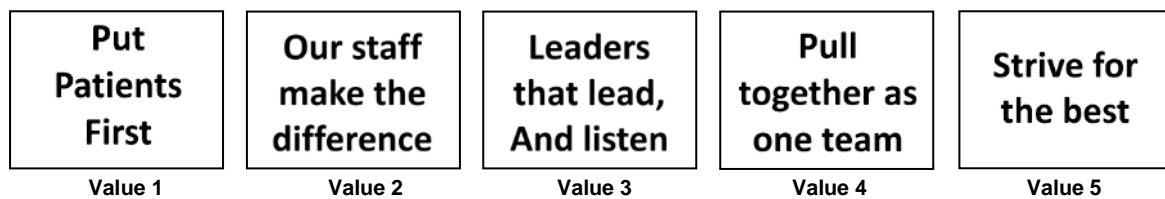


Figure 9.3 Slides shown as *Min-PPt*

In the Modalities exploratory study described in Chapter 7, I noted the possibility that short text elements may support recall more effectively than longer sections of text, and this finding inspired the employment of this modality. The minimalist text mode is shown in Figure 9.3 (for larger depiction see Appendix 8); also known as the 'Lessig' method (Reynolds, 2005a), it originates from a conference speaker of that name who pioneered a style in which short sections of large on-screen text are displayed and are timed to appear in close concurrence with speech. The technique aims to increase impact by the employment of brevity. In this variant, the Value statements were displayed with no accompanying text, and the words appeared letter by letter; carefully timed to appear at the same moment the words were spoken. As with Custom-Graphics, supporting detail was provided verbally. This presentation took 20 minutes to create, and rehearsal with a remote slide advance was required in order to achieve synchronised presentation of text and speech. Font size was Calibri 130pt black text on a white background. No images were included.

Guided imagery (Guided-Imagery)

The Guided-Imagery modality was inspired by a finding in the Modalities exploratory study reported in Chapter 7, in which some respondents remembered a scene which had only been verbally described as a visual image. An additional influence was the finding in the Lecturers exploratory study that 82% of respondents believed a well-told story could create images in learners' minds as effectively as projected images. As noted in Chapter 2, results of studies in which participants have been directed to create specific images suggest the technique might improve recall during a lecture, and if allowed sufficient time to undertake the process, might produce a beneficial effect for both high and low-imagers.

This variant did not include any projected images; instead the audience were introduced to each Value, and then asked to imagine specific situations by following

instructions provided by myself (see Appendix 9). I was uncertain whether learners should be requested to close their eyes, because as mentioned in Chapter 2, simple analogies such as Rutherford's comparison of electrons orbiting a nucleus with flies in a cathedral (Jevremovic, 2009), invite imagery but do not require the recipient to block out other visual stimuli. However, more complex imagery may require such concentration of the visual sense. To take a more complex example from the world of physics, Einstein's (1916) explanation of special relativity for non-specialists requires the reader to visualise a train with carriages; a person travelling in one of the carriages; an embankment on which the rails are laid, and lightning which strikes the rails. Such a heavy demand of imagery is likely to require a learner to at least look away from other visual stimuli, and possibly to close their eyes in order to minimise interference from other visual stimuli.

In fMRI based studies, Marx et al. (2004) found some sensory areas show a degree of deactivation following the closing of eyes, although Amedi, Malach, & Pascual-Leone (2005) suggest whether eyes are open or closed during imagery may not be critical to its effectiveness. However, experiments such as those of Marx et al. (2004) and Amedi et al. (2005) required subjects to visualise relatively simple items, and were undertaken in experimental conditions in which there were few distractions. When attempting to visualise detailed images and scenes, Kosslyn (1980) notes more effort is required to maintain such images with the eyes open, and suggests instruction with regard to closure of eyes should be at the discretion of the lecturer. I decided to induce imagery with participants' eyes open for the pilot, as I was concerned that I was introducing a teaching technique outside the range of teaching methods normally used on this event, and participants might feel uncomfortable with such an additional request. I was also aware that the effectiveness of the method might depend on the imagery skill of the learners, as cautioned by Green & Brock (2002). However, Richardson (1999) notes that VVIQ scores are not reliably related to performance in tests of recall, and for this reason I chose not to undertake a pre-test of participants' imagery abilities.

By asking participants to place themselves within a scene, I imposed a high cognitive load (Chandler & Sweller, 1991). For 'Put Patients First', I asked everyone to imagine they were talking to a patient, and then to move their point of sight through 180°, so they were then looking back at themselves through the patient's eyes. I

was aware this would require a similar degree of mental effort to the three-dimensional rotation tasks employed by Shepard & Metzler (1971), with an additional factor in that the visualiser was effectively required to place themselves within the object to be turned. This is akin to a task set in an experiment undertaken by Amorim & Isablue (2006), in which they found that by imagining a human body in the position of the 3-dimensional objects used by Shepard & Metzler (1971), the task is made easier. However, Amorim & Isablue's (2006) experiments did not require participants to imagine that the human body was themselves, so I added a further degree of difficulty in this task, albeit one which I believed to be germane to the learning outcome.

The Guided Imagery variant took approximately two hours to design and prepare.

Sample composition

Ideally, my sample audiences for the comparison of cases would have comprised groups of learners from establishments similar to those of the lecturers and trainers who participated in the Lecturers main study, namely undergraduates, trainee post-compulsory teachers, and work based learners. Such a link may have increased the transferability of results, but was not logistically feasible for me as a lone researcher. Furthermore, such an approach would have presented a potentially unresolvable problem in that I would have required a lecture topic which was common to learners in these disparate institutions. For these reasons I decided to enlist groups which were accessible to me.

Although the groups comprised an opportunity sample (Bell, 2005), they were heterogeneous in the sense that they were chosen from a cross-section of NHS staff, all of whom are required to attend 'Essential Learning' update training. The group size varied between 40 and 70 for each lecture, and comprised a mix of registered professional staff which included doctors, nurses, allied health professionals, and a range of health service support staff without a professional registration. Access to these groups was logistically practical for me because I facilitated the study days in question, and also delivered some of the lectures on the programme. The sample contained participants who held a variety of qualifications; registered staff are generally educated to degree level or above, and support staff

have no such requirement (although this does not preclude members of the latter group from this level of qualification).

Piloting

First pilot

The study design was developed through piloting, the first of which comprised a simultaneous delivery of the four visual aid modalities by myself and three colleagues in separate rooms; in which each of us employed a different modality for visual support. This approach was chosen for practical reasons; because the study day takes place bi-monthly, delivery of the four lecture modalities on the same day obviated the need for a pilot which would otherwise have required four of such events over a two month period.

I explained to participants that the reason we split into four groups was that different teaching approaches would be used for each lecture, but that I did not wish to compromise the results by the provision of too much detail at that time. I informed them that in recognition for their participation, a selection of quality biscuits would be provided at the coffee break later in the morning. Participants were randomly split into four groups of approximately 18, and led to one of four separate rooms. Pre-lecture knowledge was assessed by a questionnaire at the start of the lecture. Once the lecture had finished, another questionnaire was provided which established recall and which also contained Likert scale questions for learners to rate their appreciation of the lecture. Once the lectures were over, my three colleagues and I compared notes about delivery of our respective lectures and how they had been received by the participants. The pre-lecture questionnaire confirmed that no-one knew what the Values were before commencement of the session, and thus confirmed their suitability as a topic. Post-lecture questionnaires provided a variety of responses, from no values recalled, to five, with a spread between the two, so I decided to keep the questions in this form.

Ten days after the lectures had taken place retention was further assessed by telephone calls to a sample of 12 participants; 3 from each modality. An unexpected finding was that none of the respondents who were contacted in this way could remember anything significant about the Values, regardless of which modality they had experienced. A possible reason for this finding is that, unlike the Modalities

exploratory study described in Chapter 7 in which the lecture utilised the sole set of visual aids displayed on that day, the pilot lecture for this study took place during of a morning made up of disparate lectures and presentations, each of which was supported by a variety of images and video-based visual aids.

The poor recall over a 10 day period may represent something of an indictment of the multi-topic series of lectures employed on this day; however it should be noted that the follow up questionnaire tested recall only, and did not inquire into participants' level of engagement with the topic. The pilot result led to a reassessment of the design because I required a method which would allow a richer source of data to be acquired than was recorded in the exploratory study, but which would clearly not be achieved if no-one could recall any lecture content.

I considered using interviews to provide this data, as the open questions employed in the semi-structured individual interviews in the exploratory study provided useful data not produced by the quantitative instrument. However, the larger numbers involved in the main study precluded the use of individual interviews from a logistical viewpoint, so in order to obtain qualitative data from a number of participants I considered combined interviews in the form of focus groups. I had not run focus groups before undertaking this study; however I am an experienced recruitment interviewer and have also facilitated many group discussions, so I decided to look more closely at focus group methodology to see if this approach could provide the data I sought.

Second pilot

Following the first pilot, the post-lecture questionnaire was retained and modified to relate more closely to the research questions. The 10 day retention check was removed due to the failure of this method to produce any data, and replaced by focus groups.

As with the first pilot, the second comprised four simultaneous lectures undertaken jointly with the aid of colleagues. A post-lecture questionnaire was administered, and two volunteers from each lecture were later invited to attend a focus group. I recorded the group discussion with an Olympus DS50 digital voice recorder. I found the focus group method to be productive and informative, and it provided insight not

provided by the post-lecture questionnaires. Although I am an experienced interviewer in a recruitment setting, I had not used a recording device in place of handwritten notes before undertaking this pilot. The removal of a requirement to take written notes brought about by the use of a voice recorder was liberating to an extent I had not anticipated, and I found it allowed me to concentrate fully on the group conversation and to plan supplementary questions. However, I recorded the pilot group conversations with sound only, and when I came to transcribe the recording I found I was unable to distinguish between voices sufficiently to attribute comments to individuals; I could distinguish between male and female, but no more. I had originally decided not to use video to record the focus group conversations because I held a concern that participants may have been subdued to some extent by the knowledge they were being filmed, as cautioned by Barbour (2007) and Fern (2001). However, I realised the only way I would be able to attribute comments to participants during transcription was to record the conversations using video equipment. I resolved to do this in as sensitive a way possible to set participants at ease and to place a camera on a tripod in a corner of the room, so that it was away from participant's line of sight as they looked toward me when speaking.

Final pilot

A final pilot was undertaken in which four simultaneous lectures were again delivered, and two volunteers from each were again selected to form a focus group. I recorded the meeting with a Sony HDV 1080i video camera mounted on a tripod placed in the corner of the room. During testing I found that positioning the camera away from the participants produced poor quality sound, so I adapted the system by the addition of a Sony ECM MS907 stereo microphone which was discretely placed midway between the group and the camera. The microphone was connected to the camera by a Sennheiser EW100 radio link to facilitate its placement without a wire connection. I observed that group members soon became used to the camera and did not glance in its direction after the first couple of minutes. When I transcribed the discussions, I found the video recording allowed me to see who had made each contribution. Importantly, I discovered that when there was an audible sound which suggested a general agreement, the recorded expressions sometimes indicated that not everyone had actually agreed, and this further justified the use of video recording equipment.

In the post-lecture questionnaires, the Likert scale appreciation questions preceded the recall test. However, some of the comments recorded in the focus group conversations suggested participants' appreciation of the visual modality was affected by how successful they had been in recalling the values. I asked the pilot focus group whether their responses might have been different if they had attempted the recall test before completing the Likert scale questions, instead of afterwards as they had done. Three of the group replied that their responses might have been different, so I swapped their relative positions on the post-lecture test sheet. In this way the indications of levels of appreciation were provided only after the individual had attempted to recall the Values, and the answers were thus informed by the success or otherwise of that endeavour.

Robson (2002, p. 100) cautions against researchers using what he calls the '*post-test only non-equivalent groups design*', and suggests the methodology may be strengthened by using a pre-test. However, in the initial and second pilots, so few participants were found to have heard of the Values that I dispensed with the pre-test. In the second pilot I asked instead for a show of hands at the start of each lecture in response to a verbal question which inquired who knew what the hospital Values were. In fact only two knew what the values were so their questionnaires were excluded from the results. I settled on the use of this method as a pre-test check for this study.

In the main study the lecture was to be delivered on each occasion by myself. The rationale for having the same lecturer was to minimise extraneous variables which might otherwise have been introduced by different lecturing styles and approaches to the subject matter. This concern was borne out by the results of the pilots, in which I enlisted colleagues to provide lectures simultaneous with mine. Despite my having briefed each of them fully, both on the topic and on the importance of us maintaining common spoken delivery, post-lecture conversations indicated my colleagues had each strayed from our agreed approach and injected some of their preferred style; for instance one had initiated a discussion about the Values during the lecture.

An alternative approach might have been to enlist the services a professional speaker or actor coached to deliver the same lecture for each modality, but cost was a factor in the decision not to use this option. A further reason was that I wished to

keep the environment as natural as possible for the participants; something which might have changed if an unknown lecturer had been introduced. I decided the most practical way to maintain the same spoken content for each lecture in the main study was to deliver each modality myself, and I would concentrate on providing the same verbal input each time, as far as I was able. Kunkel (2004) used himself as a lecturer in his comparison of cases, and believed this approach had the effect of *'further establishing confidence in the comparability between the groups in each course'* (Kunkel, 2004, p. 191).

Immediately after the lecture finished, participants were asked to complete a questionnaire (see Appendix 10), and it was emphasised that the evaluation related only to the visual aids used, and not the lecturer, as is often the case with post-lecture questionnaires (Alliger, Tannenbaum, Bennett, Traver, & Shotland, 1997).

The post-lecture questionnaire established participants' recall of the five Values, and asked how the visual aids had contributed to their experience, rated on a 1-5 Likert scale. Likert scales clearly have limitations; Bell (2005) cautions against reading too much into them, and observes that because something is ranked 'five', it does not necessarily mean it is five times higher than a 'one'. Cohen et al. (2000, p. 254) further caution that *'crude data can only yield crude interpretation'*. However in the time available, this instrument was the most efficient method available to me with which to collect data from a relatively large number of respondents. I held a concern that some respondents might not provide honest answers and to this end, as the questionnaires were handed out I reiterated that responses should only relate to the visuals used, not to my delivery or to other parts of the study morning. There may also be a risk of such questionnaires causing 'evaluation fatigue' (Alliger et al., 1997), which may result in respondents completing the questions quickly and with little consideration. In an attempt to discourage this, as participants began to complete the questionnaires I iterated that they were to be used in research, and genuine responses would support the validity of the research.

9.3 Intervention 1:

Custom-Graphics

91 participants attended the lectures supported by custom-made graphics (Custom-Graphics), (Lecture A: n=49; Lecture B: n=42). Immediately after the lecture, each group received a questionnaire which required them to list all the Values they could remember, and then respond to seven questions

relating to their perception of the visual aids by marking 5 point Likert scales (see Appendix 10). At the coffee break 90 minutes later, I recruited 6 volunteers to join a focus group, which took place in an adjacent room.

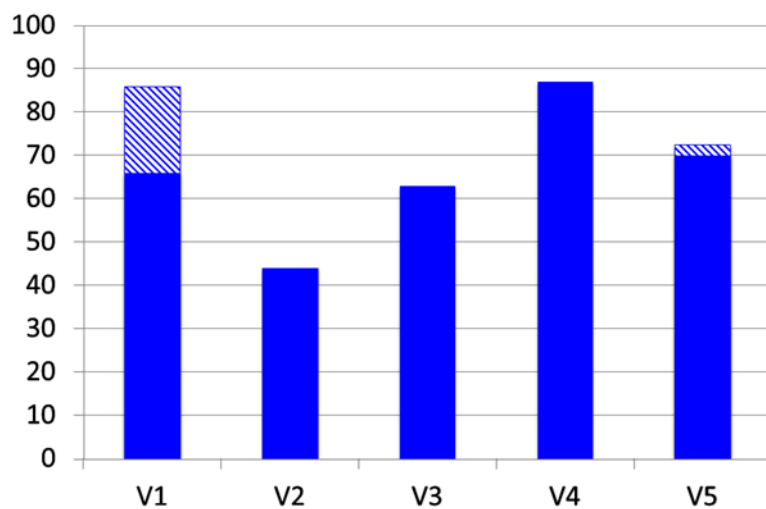


Figure 9.4. Custom-Graphics; percentage of correct answers by Value (hatched areas indicate incorrect answers which demonstrated a clearly identifiable recollection of the concept)

Short-term retention

The results for each value are shown in Figure 9.4. Each bar represents the percentage of correct answers for a given Value (for list of Values see Appendix 4). For an answer to be judged correct, key terms which related to the Value were required to be present (for more detail on the criteria applied see Appendix 12).

Following analysis of the results for Custom-Graphics, I realised that although some responses failed to meet the above criteria, many nonetheless indicated an accurate recall of either that which had actually been said, or which had been depicted in the image; in the case of Value 1, 'Putting Patients First', this was a patient's-eye view of a doctor at the bedside smiling down at them. By classifying answers as correct by the statement alone, I excluded some significant evidence of engagement; as these incorrect answers actually indicated effective recall of the concept as depicted in the image. This demonstrated a deeper engagement on the part of the learner, as they had used their own words to describe what they recalled on the response sheet. In Figure 9.4, the hatched areas in bars V1 and V5 represent answers of this type, and

it can be seen that there was an increase in correct responses for Value 1 once a reference to 'seeing through a patient's eyes' was accepted as correct.

As can be seen in Figure 9.4, the lowest number of correct responses was recorded for Value 2. The phrase 'make a difference' has been described as a cliché (Nemko, 2007), but in this context it is used as a connotative term for staff who give more in their day to day duties than just that which is defined in their job description. For example, staff who demonstrate empathy in patient communication, make a discernible effort to minimise the inherent unpleasantness of many healthcare interventions, or who generally add a human touch to their work. This concept was not accurately represented in the slide which depicted scenes in which staff merely appeared happy and helpful in their work role (see Appendix 6). Of the ten photographs which made up the collage for Value 2, eight originally contained two people; however I cut the second person from each in order to give visual emphasis to the staff member, and a consequence of this action was that the image did not clearly represent communication. This somewhat tenuous visual link with Value 2 may account in part for the low number of correct responses recorded.

The largest number of correct responses for Custom-Graphics was recorded for Value 4, 'Pull Together as One Team'. The associated slide comprised a visual metaphor in which a mixed group of staff were depicted pulling on knotted sheets as though in a tug-of-war team. The high number of correct responses may be attributable to a combination of the literality of the representation; the depiction of faces recognisable to the participants; the mixture of healthcare professions, and the light-hearted mood of the image. These features may have facilitated dual coding of the concept (Paivio & Csapo, 1973).

The Custom-Graphics slides required careful design and many hours to create, yet despite this were not found to be effective in aiding phrase recall. This may be because, with the exception of slide 4, they did not directly depict a representation of the Value statement, and as such were not task-appropriate (Schnotz & Bannert, 2003), or at least not for direct recall. However, as discussed in the section concerning engagement below, these images were task-appropriate by an affective measure, such as engagement with the subject matter.

Appreciation

After listing as many of the Values as they could recall, participants indicated their appreciation of the visual aids by responding to seven Likert scale questions. As can be seen from Table 9.2, the Custom-Graphics lectures were evaluated positively. The questionnaire contained a free section for comments and these were mostly positive, for example '*More interesting*', and '*Kept me focussed*'. Three negative comments were received; however these related to the concept of organisational Values as 'management propaganda' and as such did not reflect directly on the efficacy of the visual aids.

Table 9.2 Participant responses to *Custom-Graphics* (n=91)

	Not 1	2	3	4	Very 5
i) How interesting was the content?	1	1	26	46	17
ii) Did VAs make the lecture more interesting?	0	0	13	34	44
iii) Did VAs help you understand the information?	0	2	13	39	37
iv) Did VAs make Values easier to remember?	2	7	28	30	24
v) Did VAs make the Values more meaningful?	1	5	21	39	25
vi) Did VAs help you maintain concentration?	0	4	17	40	30
vii) Did VAs improve the experience for you?	1	1	14	38	37

The number of positive responses to the Likert scale questions did not correspond closely with the proportion of Values correctly recalled. This finding adds to those of Szabo & Hastings (2000), Bartsch & Cobern (2003) and Savoy, Proctor, & Salvendy (2009) in which what students say they appreciate regarding visual aids shown in their lectures, and what is found to actually assist their learning, are not necessarily congruent.

Engagement and understanding

After the Values lecture, participants received a further 90 minutes of lectures on unrelated subjects such as 'moving and handling', and 'counter-fraud precautions'. At the coffee break six volunteers were recruited to form a focus group held in an adjacent room. Transcripts of the group conversations were made, and then

analysed with the aid of NVivo software; themes and sub-themes were identified, and the outcomes are recorded below.

Theme 1. Images are capable of providing more than simple embellishment.

As soon as Custom-Graphics focus group participants began to speak, it was evident that an affective experience had taken place that was not reflected in the post-lecture questionnaires, and that Custom-Graphics images had impacted significantly on both attention and engagement. Participants described how they liked the images, and expressed a general agreement that they had captured their attention and added interest to the lecture. However they noted that for images in which the connection with a Value was less clear (Slides 2 and 5), my explanation was required in order for the image to be effectively linked with the Value.

i) Listening and looking simultaneously

By definition, a visual aid should provide some assistance to learners, and Custom-Graphics participants confirmed the images added content to the lecture for them. They described how they had found it easy to listen to me and study the images simultaneously, and thus confirmed minimal split attention (Chandler & Sweller, 1991) was present for this modality. Whilst I delivered a narration, the images provided supplementary information, and appeared to have utilised learners' visual working memory concurrent with their auditory working memory.

The interest stimulated by the graphics did not exclusively direct learners' thoughts in the directions intended however. Some described how they had noticed irregularities in the images; for example, the doctor depicted in the first slide was wearing sleeves down to her wrists, when in fact they should have been rolled above her elbows. This proved a distraction for some participants who spotted the error (the same slide was shown in the pilot studies, but no-one had mentioned the mistake). It is possible that I did not guide the learners sufficiently into the pictures; Schnotz (2001) cautions that learners often miss some informational content of pictures, and even though I did interact with the images in this modality, I might have avoided distractions such as that created by the doctor's sleeves by guiding learners into the pictures as soon as they appeared. By introducing the images as I spoke, and then only referring to them a minute or two later, I allowed learners to explore them at their will.

ii) Recognisable faces increase impact and aid recall

A recurring theme in the focus group discussion was the visual impact of staff known to group members. For those unfamiliar with the staff depicted in the photographs this effect was less marked, although the observation that the locations and uniforms were those of their own organisation created an impact (NHS uniforms vary significantly in style and colour between hospitals). Both Custom-Graphics focus groups agreed this effect would have been reduced had the photos been taken at another hospital; they felt group membership was important; just seeing 'a nurse' was not considered sufficient. This finding is of particular relevance to lecturers and teachers who create their own visual aids, as a common recommendation for creators of presentation slides is to search for photographs on the Internet or purchase 'iStock' or 'Corbis' commercially produced images (see for example, Atkinson & Mayer, 2004). Such stock images are often created in the USA, and in the context of healthcare, doctors are usually depicted in white coats; a practice which ceased in the UK in the late 20th century. In general, although stock images tend to be created to represent racial and gender distributions, to date the holders of such collections do not appear to make the same effort to represent variations in disability, age, body size and shape, and often depict people who look like photographic models (Karrer, 2012).

Images which are instantly recognisable as accurate in relevance and source are likely to create a greater impact on the viewer, as noted by Knobloch et al. (2003) in their study of responses to photographs published in newspapers. The impact of faces known to the participants may be accounted for in part by social identity theory (Turner & Oakes, 1986), and the staff depicted in the images may have been perceived as part of the learners' 'in-group'. This suggests identification with individuals portrayed in images is a factor which lecturers might utilise when planning visual aids. An aspect for further research may be to compare the impact of commercially produced photographs with authentic local images displayed in support of a common lecture.

iii) Facial expressions and affect

The majority of staff depicted in Custom-Graphics were smiling, and from descriptions received from focus group members, this appeared to have increased the impact; for example one said they made her feel, *'I'd like to work with those*

people'. I did not specifically ask the staff to smile when I took the photographs, yet most had done so and one group member observed I had chosen '*some fabulous staff*'. The positive affect of these images was reiterated throughout the Custom-Graphics focus group discussions. In the slide which depicted a group of ward staff pulling on a sheet in the style of a tug-of-war team, some of the staff were laughing, and the combination of a positive image and their good humour appeared to have induced a positive mood among those viewing the images.

iv) Tangential impact

Three focus group members described how elements contained in the slides had stimulated further thoughts, for example, one explained how the picture taken from patient's eye view had caused him to ponder,

'how we don't often think what it's like to look up at staff'.

Another described how the images had resulted in him,

'considering spending a minute or two longer with my patients'.

This impact was not manifest in the questionnaire comments, and emerged only during the focus group discussion. Such a reaction was exactly that which the organisation would wish the Values to engender, and these findings further highlighted the benefit of holding focus groups in order to gain data (Kitzinger, 1994).

Theme 2. Learners' re-creation of images during recall

All focus group members reported being able to accurately re-imagine images whilst they answered the post-lecture questionnaire. When they attempted to recall the images again in the focus group 90 minutes later, some members held their arm out and used an index finger to point to spatially relevant sections of the images, which suggested they were viewing a re-constituted image in their 'mind's eye'. For example, when referring to the image which supported 'Strive for the Best' represented by a depiction of awards and faces of hospital staff in Slide 5, one member stretched out her arm and pointed in turn to four points of a cross, and described the position of the trophies portrayed in the slide, while saying '*there were four of them*'. Others made similar movements when describing recalled images. This suggests images displayed during a lecture may be capable of accurate reconstruction when no longer visible to the student, and thus accessible at a later

point in the discussion, even though participants may not have been instructed to try to remember them at the time.

Theme 3. Accompanying words on-screen

Respondents agreed that the representation of the Values as images made them '*more acceptable*'; conversely, they felt that their display in text form would have been perceived as '*organisational propaganda*'. Nonetheless some suggested they would have liked to see text displayed alongside the images; one member said, '*I couldn't tell you the words because I hadn't seen them*'. It is uncertain whether this expressed desire was based on an inability to 'see' the written Values during attempted recall; the way in which it was expressed suggested some participants may have attempted to replay the Value from auditory memory. For future research, additional insight might be gained by a comparison of images-only, with images accompanied by brief text. Such an investigation is recorded in the literature, but only with computer-based displays and recorded narrative (Mayer et al., 2001), and in which there was no lecturer to compete for attention.

There was a general agreement that the theme which underpinned the Values was more important than the statements themselves; one asked, '*how important are the actual words?*' Another queried whether '*knowing*' the Values in the sense of being able to regurgitate the words '*meant anything*'. One member referred to previous experiences of reading text from a screen as '*just torture*', and expressed their appreciation that I had provided no text.

9.4 Intervention 2: Trad-PPT

84 participants (Lecture A, n=34; Lecture B, n=50) attended the lectures supported by 'Traditional' PowerPoint (Trad-PPT). In accordance with common practice, I did not provide temporal pauses during the lectures to allow learners to read the text. As each slide appeared, I named and described the Value contained on that slide, although I did not read aloud words contained in the visual aid as reported by some studies (Apperson et al., 2006; Kunkel, 2004).

Short-term retention

Figure 9.5 shows the percentage of correctly recalled Values statements recorded on post-lecture questionnaires. As with Custom-Graphics, they appear to show a serial position effect (Murdock, 1962) in which the first and last items displayed

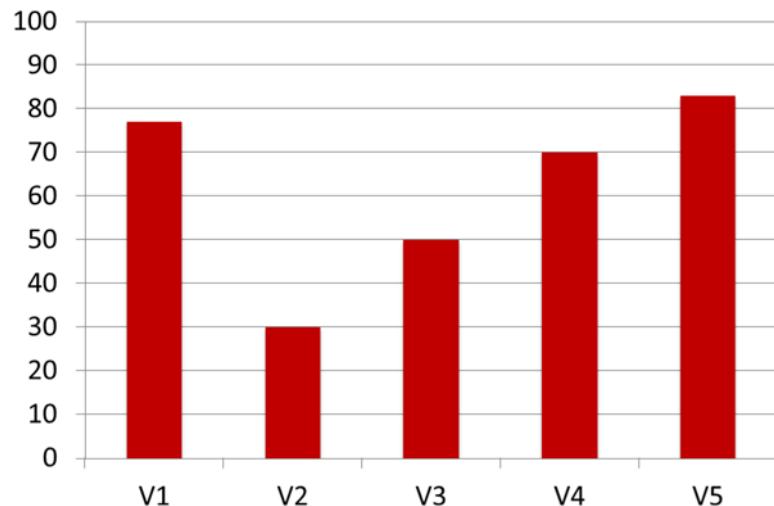


Figure 9.5. 'Trad-PPt'; percentage of correct answers by Value

were recalled more effectively by participants. The high number of correct answers for Value 5 suggest the stronger recall of the last value may be due to a 'recency' effect brought about by its position at the end of the display sequence, while the number of recall answers for Value 1 indicates a possible 'primacy effect' resulting from material presented first being stored in long-term memory (Miller & Campbell, 1959). However, experiments such as those of Miller & Campbell (1959) in which serial position effects were established, employed lists of words delivered over planned time intervals, so a serial position effect cannot be firmly established in this study.

Value 2 again returned the lowest proportion of correct responses (30%). This Value statement is the least clearly defined of the five, and is non-specific with regard to exactly what such a difference might entail, and as noted above, its common usage has resulted in it becoming something of a cliché. An Internet search undertaken with 'Google' for the phrase 'making a difference' returned 19.5m results. Qualifying statements were included on the slide, but these were also rather nebulous, for example 'We will be clear about responsibility', and might also be considered somewhat platitudinous.

The low recall scores recorded for Trad-PPt may be attributable to extraneous cognitive load (Sweller et al., 1998) created by competing demands of text and speech, which although simultaneous, were not identical and were not paced with reading speed. Such demands, also known as 'PowerPoint overload' (Yilmazel-

Sahin, 2009), placed upon working memory may have produced inferior retention due to the provision of two competing sources (Sweller et al., 1998).

Lecturer compensation

When lecturing with this modality, I compensated for what I perceived to be a sensory void by the addition of an emotive story about a hospital porter who had an opportunity to ‘make a difference’ by speaking to a patient when wheeling her along a lengthy corridor journey, but did not say one word to her. At the time I was not aware the story created an impact; only later did the focus group reveal its effectiveness in creating a lasting memory. Yet despite the addition of the story, Trad-PPt produced the lowest scores in response to the appreciation questions, and the fewest favourable comments among focus groups.

Appreciation

There was a mixed reaction to the Trad-PPt mode as can be seen in Table 9.3, and no responses were selected in columns 4 or 5. These results corresponded with poor retention scores recorded for this modality.

Table 9.3 Participant responses to Trad-PPt (n=84)

	Not 1	2	3	4	Very 5
i) How interesting was the content?	1	10	<u>44</u>	22	7
ii) Did VAs make the lecture more interesting?	12	<u>23</u>	19	16	14
iii) Did VAs help you understand the information?	10	16	<u>32</u>	17	9
iv) Did VAs make the Values easier to remember?	18	<u>26</u>	24	11	5
v) Did VAs make the Values more meaningful?	21	<u>23</u>	<u>23</u>	14	3
vi) Did VAs help you maintain concentration?	16	<u>25</u>	18	22	3
vii) Did VAs improve the experience for you?	12	23	<u>28</u>	17	4

Additional comments recorded on the response sheets included;

‘Needs to be more eye-catching’,

‘They were very plain, just words, so did not help at all’,

‘Boring and stark to look at’.

Overall Trad-PPt was not positively evaluated, and this finding concurred with the results from the exploratory study described in Chapter 7. No handout was provided and there was no anticipation of any future examination or test, which the literature suggests is often linked with student preferences for this modality.

Engagement and understanding

Theme 1. Unfavourable reaction

The Trad-PPt groups produced an unfavourable reaction to the text-heavy slides. Many negative comments were recorded such as:

'The words were patronising'

'I didn't need it up on the screen to tell me'

'It was OK for a few minutes, but after that...I was losing the will to live!'

'If you hadn't talked around each of them, it would have been awful'.

These concur with written comments recorded on the post-lecture questionnaires.

Theme 2. Slide content

i) Slides contained too much detail

Group members reported they were able to recall the main Values displayed in slide title, but not any of the content indented below. However, when asked specifically what they were able to recall, they were unable to recall any specific words,

'I can picture writing, but I can't see the words'.

Several agreed they would have preferred the Values headings alone, without the explanatory bullets below, *'one slide per point'* and, *'the shorter the better'*.

ii) Colour and font choices

Some members suggested a variation in fonts or colours might have helped, for example, *'yellow text on a blue background would have been nicer'*. Although when I asked participants to explain how they felt such variations would have aided their recall, there was a general agreement that although more pleasant to look at, such a variation in appearance may not actually have helped. In the Modalities exploratory study reported in Chapter 7, those who attended Trad-PPt saw a projection of white text on a blue background, and reported being able only to recall the colours. This is not to suggest that finding something *'nicer'* is necessarily specious, as the removal or reduction of a negative aesthetic element may enhance learner mood (see for example, Brand, Reimer, & Opwis, 2007; Ellis, Thomas, & Rodriguez, 1984).

However, whether a variation of font and colour alone would be sufficient to achieve a measurable impact remains unclear and warrants further investigation.

Kitzinger & Barbour (1999) caution that focus group members may provide each other with misinformation which can be legitimised by the presence of the researcher. Such a situation arose with my second Trad-PPT focus group, in which one member qualified one of her comments with, *'actually I'm a trainer'*, and proceeded to validate her comments by espousing VAK theory (Smith, 1996), and added a suggestion that text may suit visual learners. This placed me in a sensitive situation as I wished to steer the discussion away from such proffered wisdom. Despite this, in the ensuing discussion the group agreed that text on a screen was not something that appealed to those who liked to see images as visual aids.

Preference for video

Two Trad-PPT participants said they would have liked something visual, in the form of a combination of images and brief text. This discussion developed into a suggestion that all the Values might be combined in a single scenario acted out in a video *'visual rendition such as play-acting... with bullets as a handout'*¹.

Theme 3. Difficulty reading and listening simultaneously

There was unanimous agreement among Trad-PPT focus groups that they had been unable to read the slide content and listen to me simultaneously; this had apparently presented them with a dilemma with regard to which they should attend, and confirmed the presence of a 'split attention effect' (Chandler & Sweller, 1991). They reported making an initial attempt to read the slide and listen simultaneously, and recalled making a conscious decision not to attempt both and to listen to me instead. One said he decided to do this because he was *'learning more from you [me]'* This finding does not accord with those of Yue et al. (2013) that changing textual iteration so that it differs from narration improves recall; because in my study the text was different to the spoken language, and the effect is more likely to arise from a split attention effect brought about by my presence at the front of the lecture theatre.

One group member differentiated between text used in a presentation and that provided for revision, and observed that when revising the action is different. As

¹ This proposal has been accepted as a project by my employing organisation and is currently awaiting funding.

noted in Chapter 3, some researchers have recorded students' preference for PowerPoint text-based slides in the context of their future use for revision, however in this study there was no anticipation of future testing or associated revision, which may account for their poor showing in the post-lecture appreciation questionnaires, and in the focus groups.

Theme 4. Lecturer impact

One group member said that I *'made it come alive'*, by asking questions such as *'Do we do this?'* and then building on the responses by asking, *'What proportion of our staff do this?'* Others agreed that I had encouraged discussion, and some expressed an opinion that the outcome would have been similar if there had been no slides at all. In response my question which enquired whether the text-based slides might have been more beneficial for participants if there had been a less confident lecturer, both groups agreed they would not; they expressed a belief that a large amount of text on-screen would make a poor lecturer seem *'even worse'*.

Despite my many years' experience of working in a teaching environment, both focus groups said they noticed I was not at ease with the text-heavy slides. In fact I had found it challenging to speak naturally while this modality was displayed, as it represents a contrast to my usual style in which I make parsimonious use of on-screen text. I had also felt quite self-conscious despite the fact that this form of visual support is very popular, and I had not anticipated the effect and strength of this feeling.

9.5 Intervention 3: Min-PPt

97 participants attended the lectures supported by Min-PPt (Lecture A, n=39; Lecture B, n=58), also known 'Lessig' style after the American academic credited with its inception (Reynolds, 2005a).

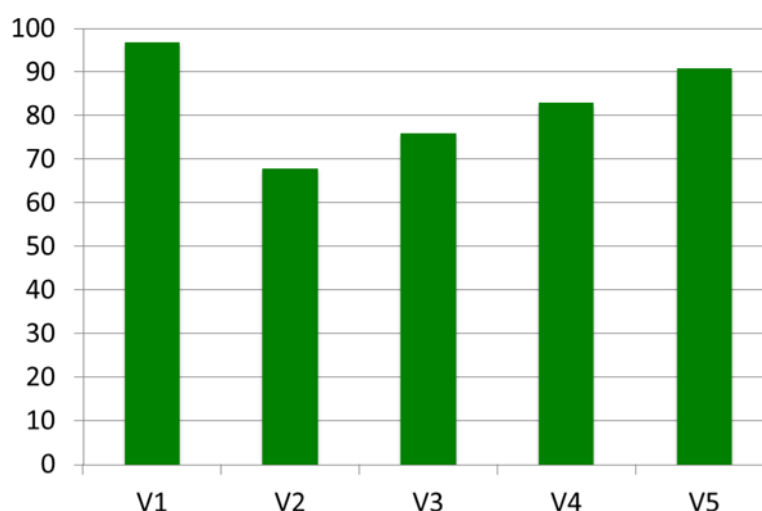


Figure 9.6. 'Min-PPt'; percentage of correct answers by Value

Short-term retention

The results are shown in Figure 9.6 and appear to indicate a serial position curve similar to the Trad-PPT mode in Figure 9.5, but with significantly higher overall scores for each Value. Slide 2, 'Our Staff Make the Difference' again provided the lowest number of correct responses, and it is likely the tenuousness of this Value contributed to a lower response.

Appreciation

The Likert responses for appreciation of the visual aids are shown in Table 9.4 and suggest the modality was broadly (although not exclusively) well received.

Table 9.4 Participant responses to 'Min-PPT' (n=97)

	Not 1	2	3	4	Very 5
i) How interesting was the content?	3	11	39	26	18
ii) Did VAs make the lecture more interesting?	5	16	17	30	29
iii) Did VAs help you understand the information?	5	12	27	26	27
iv) Did VAs make the Values easier to remember?	10	14	25	25	23
v) Did VAs make the Values more meaningful?	22	20	23	19	13
vi) Did VAs help you maintain concentration?	8	11	30	25	23
vii) Did VAs improve the experience for you?	6	10	26	34	21

Positive responses were recorded:

'Good...not fussy and dressed up...gave a bigger impact.'

'Clear and concise.'

'Good idea, but only if you are a visual learner.'

'Along with the delivery of the PowerPoint presentation the Values lecture proved insightful.'

Although not everyone agreed:

'Would have held my attention better if there was [sic] pictures. Overall they made it easy to remember the Values'

'I would have liked more interesting slides to make me think about the Values which would help me remember.'

'Photos would have made it more interesting and easier to remember.'

'Boring'.

And a functional:

'I didn't need my glasses to read them.'

Engagement and understanding

Theme 1. Font and colour selection

In common with Trad-PPT focus groups, Min-PPT participants agreed that changes in appearance between slides would have helped them differentiate between Values, and some expressed a belief that the similar slide design resulted in content becoming merged in their memories. They suggested that the employment of different colours, varying fonts, and the numbering of individual slides would have created more visual impact and supported recall. However, I pursued this point, and participants were uncertain whether this would merely have resulted in remembering the differences between colours and fonts, or whether it might have aided recall of the Value statements. The findings of Paivio, Rogers, & Smythe (1968) suggest it may not have supported recall; they found the addition of colour cues to text did not enhance memory when compared with black and white versions of the same words. A discussion took place around whether each Value might have a colour permanently associated with it, and this notion, along with colour associated with specific fonts, is a possible area for further research, although it is perhaps more closely allied to the requirements of branding in the commercial world than teaching.

Theme 2. Use of single words

Despite the restriction of five words per slide, several group members felt there were too many words, and they suggested a single word which represented each Value might have been more effective as a memory aid. This approach has been recorded in contemporary use, and is known as the '*Takahashi*' method after its inventor Masayoshi Takahashi, who displays single Japanese characters on each slide, in the style of a Japanese newspaper headline (Reynolds, 2005b). The effectiveness of western text displayed as single words in a lecture is yet to be assessed, and is an area for future investigation.

I created Min-PPT so that the words on each slide appeared at the same rate as my speech, and when delivering the lecture I used a remote slide advancer to ensure each word appeared concurrent with my speech in order to minimise any split

attention effect (Chandler & Sweller, 1991). Participants reported they were not aware of my careful timing, and felt the text could be read sufficiently quickly to not interfere with listening, even if not synchronous. This suggests that a split attention effect may not occur below a certain number of words, and further research is required to gain more insight into the potential impact of this modality.

Theme 3. Image-effect of text

Although Min-PPt contained only text, an element of visual recall was described by two group members. One remembered the juxtaposition of the first syllable of 'Leadership' and the word 'Lead' situated below it, and recalled these as a visual coupling. Another remembered the visual alliteration of three 'L's on the slide 'Leaders that Lead and Listen'. These participants described how they were able to recall text visually when asked to recall and write down the Values. When they described this in the focus group, one pointed in front of herself and indicated where she saw the letters positioned on the screen; in doing so she traced out a reconstructed image in a similar manner to those who re-imagined photographs described in section 7.2 above. However, despite this, no-one reported being able to 'see' complete words during recall;

'I could picture all the black letters on the screen, but I couldn't work out what they were saying'.

Interestingly, one group member said he had not noticed the size of the text,

'I didn't notice it was particularly big...I was listening more than looking'.

Theme 4. Text and memory

Apart from the visual alliteration described above, group members reported they were unable to recall any of the words displayed. However they had visualised the story of a porter who had not bothered to speak to a patient. Group members suggested two images might be offered as a contrast; the porter as he was in the story, and a second in which he was kind to the patient, with the question posed in text, 'Which do you want to be?' Such a technique would introduce a form of 'demand picture', as described by Kress & Van Leeuwen (1996, p. 122), in which the image demands something of the viewer; in this case a response based on conscience. However, this effect is usually limited to situations in which there is no-one present to articulate the demand.

Theme 5. Lecturer effect

As in other groups, the question of the lecturer's skill in engaging interest was included in the discussion; Min-PPt groups complemented me on being '*easy to listen to*' and this caused me to question whether my personal involvement may have affected the results. I asked whether a less engaging style of lecturing might have led to them paying more attention to the slides and less to me, but they unanimously disagreed, and replied they would have been less likely to listen. One encapsulated the feeling by saying they would probably go '*back to their phone*', referring to the competing attraction of applications contained within a 'smartphone' in such situations.

9.6 Intervention 4: Guided-Imagery

100 staff attended the lectures supported by guided imagery (Lecture A, n=48, and Lecture B, n=52). I endeavoured to create scenes in the minds of participants and asked them to imagine specific scenarios; in some they were an actor, in others they were an observer. As far as I was able to ascertain, everyone participated in what Mitchell (1994, p. 158) refers to as the '*verbal conjuring*' of an image by descriptive speech; throughout the lecture everyone appeared to concentrate and kept their eyes closed as requested.

Participants were asked to relax, close their eyes and imagine a scene which I described to them (for a summary of the transcript see Appendix 9). I incorporated minimal movement in the scenes, although the scenarios were not equitable to a still image. For Values 1, 2 and 5,

participants were placed in the scene as an actor, for Values 3 and 4 they were asked to imagine someone else enacting a scene in which they were an observer.

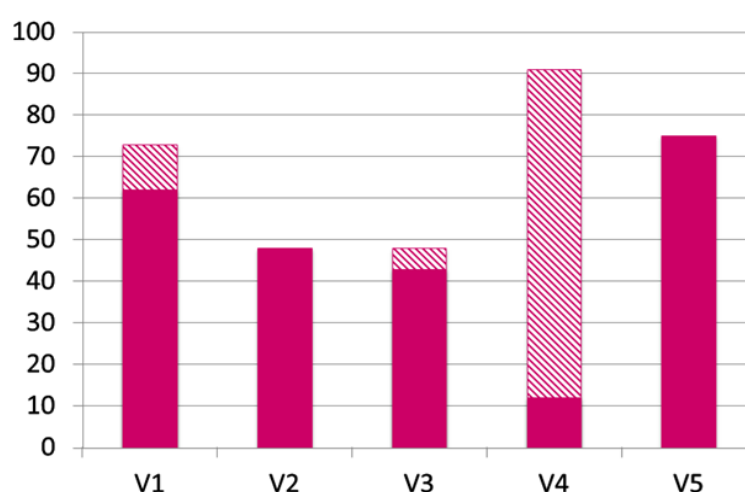


Figure 9.7. Guided-Imagery; percentage of correct answers by Value (hatched areas indicate incorrect answers which demonstrated a clearly identifiable recollection of the concept)

Short-term retention

Figure 9.7 shows the results of phrase recall; hatched areas indicate answers which did not qualify as correct, but which demonstrated a clearly identifiable recollection of an element of the imagined scene. The largest such effect can be seen for Value 4, in which only 13% recollected a statement which contained the words ‘Team’ and either ‘Pull’ or ‘Together’. However, when I encouraged participants to visualise this Value, I had asked them to imagine they were,

‘all like ants, working together for the common good, no-one needing to give instructions, because everyone instinctively knows what to do...and does it’.

Although I mentioned ‘ants’ only once, when the answers which contained both ‘Team’ and ‘Ants’ were accepted, the number of correct responses rose to 91%.

Appreciation

Learner appreciation results are shown in Table 9.5. The post-lecture questionnaire for this modality contained an additional question, ‘Would you have liked Visual Aids as well?’

Table 9.5 Participant responses to *Guided-Imagery* (n= 100)

	Not 1	2	3	4	Very 5
i) How interesting was the content?	3	10	38	36	13
ii) Did VAs make the lecture more interesting?	5	9	27	35	24
iii) Did VAs help you understand the information?	7	16	20	36	21
iv) Did VAs make the Values easier to remember?	14	20	19	38	9
v) Did VAs make the Values any more meaningful?	4	20	18	37	21
vi) Did VAs help you maintain concentration?	12	15	21	31	21
vii) Did VAs improve the experience for you?	9	17	24	30	20
	No				Yes
viii) Would you have liked VAs as well?	11				31

A positive appreciation was recorded for this modality overall. It may be that although I gave participants the opportunity to create a mental experience (and from their reaction everyone appeared to do so), this experience was not instrumental in assisting their memory of the Values statements. Space for comments was provided after the supplementary question. Comments included:

‘Visual aids wash over you; if you create it yourself, it is more powerful’

‘Very good way of approaching the Values’

‘Initially difficult to recall; but when I really thought about it, it triggered the list of Values’

‘I think actual visual aids would have helped, maybe after we had visualised’

‘I am a visual learner so the visual aids as well would've been fab’

It should be noted that these answers were provided immediately following the attempt to recall the statements, and so should be interpreted in that context, rather than on appreciation of the modality alone. The last of the responses quoted above was of particular interest, because this participant clearly felt that the use of imagery did not match her ‘visual’ preference. This respondent did not attend the focus group so I was unable to explore this response further, but such a perception may be linked to differences in abilities with regard to object imagery and spatial imagery (Blazhenkova & Kozhevnikov, 2009) and warrants further investigation in environments such as that used in this study.

Engagement and understanding

Theme 1. Experience and image recall

When focus group members recalled scenes visualised during the lecture, some traced out elements in front of themselves using a finger, in a similar way to those who attended Custom-Graphics. This observation supports the notion that imagery enlists some elements of the brain in common with viewing an image (Ganis et al., 2004; Kosslyn, 2003). Participants’ recall of the scenes appeared to me to be slow as they accessed the memory during the focus groups, and this may have been due to reconstitution of a moving scene, which played out over a period of seconds. This observation accords with the findings of Decety, Jeannerod, & Prablanc (1989) who found subjects took approximately the same amount of time to imagine themselves walking between two points as when they traversed the actual distance. My participants described being able to recall their imagined scenes accurately in the focus groups 90 minutes after the actual experience. This suggests imagery may be able to produce accurate recall within the timeframe of a lecture.

Theme 2. Creation of mental ‘pictures’

One member explained that participation in guided imagery had been *‘hard at first’* because they were *‘geared up for PowerPoint’*. Others agreed, and added that once they realised what the lecture entailed, they found it an *‘enjoyable experience’*. All focus group members said they were still able to *‘see’* the scene they had visualised during the lecture when they attempted to do so 90 minutes later in the focus group, and referred to, *‘the pictures’*, *‘the visuals’*, and *‘the pictures in my head’*. One described how, in the scenario for Value 3 (Leaders that Lead and Listen) he had, *‘pictured someone walking into work that day, and what was running through their mind’*, and added *‘I could really picture someone doing that’*. His description that he was able to picture, *‘what was running through their mind’*, suggested he had experienced an extra dimension during the imagery, in which he had identified with the person, so that in some way he was able to link with their thoughts.

Mitchell (2008) suggests a difference between a physical picture and an image is that *‘you can hang a picture, but you can’t hang an image’* (Mitchell, 2008, p. 16). With this comment in mind, I asked the Guided-Imagery focus groups if, within the limits of their drawing ability, they would be able to sketch their recalled images. Everyone expressed a belief that they would be able to do so, and thus would presumably have been able to *‘hang’* a physical depiction of that which they had imagined. On reflection, it might have been instructive to include such a drawing in order to observe the level of detail with which participants were able to reproduce their internalised images.

Image content

Group members described how, when asked to visualise someone with particular attributes, they had *‘picked specific people to think of’*. One explained she was *‘thinking of colleagues that do strive to do their absolute best’*. Such imagery was not straightforward for everyone however; two participants described how, in the scenario for *‘Leaders that Lead and Listen’*, they had been unable to picture anyone, as they did not know a manager who possessed such attributes. Only when I offered an alternative scene which included a poor leader, were they able to imagine a scene.

For some of the Guided-Imagery scenes I offered a choice to participants to place themselves as the central character or to choose someone else. For example, some had chosen to imagine themselves coming to work in the morning and thinking about what they would do during the forthcoming shift; while others had pictured someone else doing this. The finding that participants made a choice with regard to whether they placed themselves in the scene or visualised it as an observer, supports the notion that different spatial abilities may have been present among the group.

Theme 3. Ability to visualise

Group members described differing ways in which they fulfilled the tasks. Some reported they had been able to do exactly as I had asked,

'I was totally looking at me...I could see me standing at the end of the bed and everything, I found it really useful'.

Some reported they were unable to undertake the reversal; instead they imagined looking at themselves interacting with a patient as though they were observing the scene from nearby,

'I couldn't see myself as myself, but I could see the situation...I was...a third party'

I presented a demanding task in this element of the Guided-Imagery modality. As well as rotating the scene through 180°, participants were effectively required to imagine leaving their own head. One described the experience as *'stepping outside my body'*.

Marks (1973) established a scale of imagery which quantified an individual's ability to visualise; the Vividness of Visual Imagery Questionnaire (VVIQ) which ranged from:

- 1. Perfectly clear and as vivid as normal vision' to*
- 5. No image at all, you only 'know' that you are thinking of the object*

(Marks, 1973)

Such individual differences may account for the variation in the experiences reported by focus group members. However, of relevance to teachers or lecturers who may consider utilisation of such techniques is the finding that despite reported differences in ability, everyone in the focus groups had been able to undertake imagery in some way. One explained that ordinarily, she did not like looking at herself in a mirror or photograph, and this prevented her from doing so in the imagery. Nonetheless, she

had been able to imagine the proffered scene as an observer. Another explained that although she was unable to see herself in the imagery, she could imagine herself thinking '*as the patient*', and she knew that her '*real self*' was standing '*towering over the patient*'. From her description, this participant seemed to have been able to transfer herself into the patient's thoughts as a form of a proposition, rather than as an experience. She described how the patient (herself) had to tip her head back in order to look up (at her).

Differences in ability to visualise did not seem to prevent individuals from achieving some form of relevant experience and is supported by the observation of Richardson (1999) that VVIQ scores are usually related only weakly (if at all) to tasks which require learning or memory. Although demanding for participants, the Guided-Imagery tasks appear to have provided a germane cognitive load for those who reported their experience in the focus groups. Fourkas, Avenanti, Urgesi, & Aglioti (2006) suggest that imagining oneself from an external perspective may activate the same neurons as imagining oneself carrying out an action in the first person. However, Fourkas et al. (2006) studied imagery which concerned the movement of a single finger, and the extrapolation of this finding to a complex social interaction as used in this exercise may be unrealistic. Nonetheless, the results of this study were sufficiently encouraging to warrant further research into the practice of using imagery in lectures which contain suitable topics.

As noted in Chapter 2, participants may take an experimental task more seriously if they perceive the individual who proposes the action to be like themselves (Richardson, 1987), and it is possible that the reports of successful imagery may have been influenced to some degree by focus group volunteers who identified with me in some way. However, the notion that descriptions of successful imagery may be affected by social desirability (Di Vesta et al., 1971) was discounted due to the ability of focus group members to provide vivid descriptions of their experiences.

All focus group participants agreed the exercise had been worthwhile. No-one had felt uncomfortable, and although I had given participants the option of whether or not to close their eyes, everyone had done so. A caveat was expressed by two members, who said they would have preferred more time in which to experience the imagery.

9.7 Comparison of the four interventions

Recall of Values statements

Figure 9.8 shows recall scores for Values statements by modality. The hatched areas indicate additional responses which were not accurate but demonstrated recall of a relevant element contained in the lecture. The modality which provided greatest impact on accurate phrase recall was Min-PPt (83%), and least effective were Guided-Imagery and Trad-PPt (62%). This is a significant finding because the effectiveness of Min-PPt in supporting recall may be attributed in part to the modality containing minimal extraneous cognitive load (Sweller et al., 1998), i.e. unnecessary load imposed by learning design. However, the minimalist design also provided only minimal germane cognitive load, although the effectiveness of this modality in supporting recall provides support for Mayer's (2008) suggestion that the provision of brief text in accompaniment to narration may help learning. It is possible that the short phrases utilised the visuo-spatial sketchpad, and not the phonological loop as suggested by Baddeley (2000), and thus allowed processing which was concurrent with that of my spoken words. An alternative explanation might be that such simple phrases were processed by a third independent processing channel as postulated by Schnotz (2005).

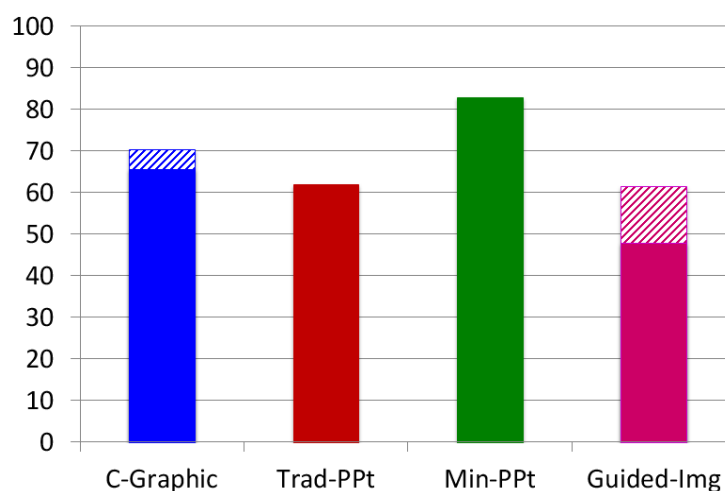


Figure 9.8. Total Values recalled by modality (hatched areas indicate incorrect answers which demonstrated a clearly identifiable recollection of the concept)

A Kruskal-Wallis test showed a statistically significant difference in recall score between the four intervention groups, $\chi^2(3) = 54.97$, $p = 0.000$, with a mean rank recall score of 253.24 for Min-PPt, 173.88 for Custom-Graphics, 160.64 for Trad-PPt and 154.97 for Guided-Imagery.

When the scores were adjusted to include answers which demonstrated a clearly identifiable recollection of the concept, the following result was obtained: $\chi^2(3) =$

52.24, $p = 0.000$, with a mean rank recall score of 248.79 for Min-PPt, 185.57 for Custom-Graphics, 154.41 for Guided-Imagery and 153.79 for Trad-PPt.

In order to establish which groups were significantly different to each other, I carried out follow-up Mann-Whitney U tests between pairs of modality groups, and the results are shown in Table 9.6 below.

Table 9.6 Recall by modality pairing

Modality pairing	<i>U</i>	<i>z</i>	<i>p</i>
Custom-Graphics (<i>Md</i> = 3), Trad-PPt (<i>Md</i> = 3)	3520.0	-.935	.350
Custom-Graphics (<i>Md</i> = 3), Min-PPt (<i>Md</i> = 5)	2404.5	-5.61	.000
Custom-Graphics (<i>Md</i> = 3), Guided-Imagery (<i>Md</i> = 3)	3991.5	-1.51	.132
Trad-PPt (<i>Md</i> = 3), Min-PPt (<i>Md</i> = 5)	2017.0	-6.07	.000
Trad-PPt (<i>Md</i> = 3), Guided-Imagery (<i>Md</i> = 3)	4013.0	-.532	.595
Min-PPT (<i>Md</i> = 5), Guided-Imagery (<i>Md</i> = 3)	2442.5	-6.22	.000
Modality pairing (scores adjusted for engagement)			
Custom-Graphics (<i>Md</i> = 4), Trad-PPt (<i>Md</i> = 3)	3085.0	-2.29	.022
Custom-Graphics (<i>Md</i> = 4), Min-PPt (<i>Md</i> = 5)	2731.5	-4.72	.000
Custom-Graphics (<i>Md</i> = 4), Guided-Imagery (<i>Md</i> = 3)	3690.0	-2.33	.020
Trad-PPt (<i>Md</i> = 3), Min-PPt (<i>Md</i> = 5)	2017.0	-6.07	.000
Trad-PPt (<i>Md</i> = 3), Guided-Imagery (<i>Md</i> = 3)	4153.5	-.133	.895
Min-PPT (<i>Md</i> = 5), Guided-Imagery (<i>Md</i> = 3)	2547.0	-5.96	.000

A Bonferonni adjustment was applied in which the alpha level was divided by the number of comparisons made, and a significance level of .008 was established. The results indicated a significant difference in the numbers of correct answers provided by three pairings; Custom-Graphics and Min-PPt, Trad-PPt and Min-PPT, and Min-PPt and Guided Imagery. This applied to both data sets. In each pair, Min-PPt participants achieved a significantly higher proportion of correct answers than the opposing group in the pairing.

It is possible that the presentation of brief text facilitated imagery of the Value statement itself when participants attempted to recall the phrases, although this notion was not borne out by the focus groups. It may also be that this modality created the most marked impact on memory of the phrases because the slides contained no extraneous information.

Trad-PPt slides contained the most complete and detailed information of all the modalities, and the finding that this modality had a low impact on recall compared with Min-PPt suggests the commonly used technique of placing 40-60 words on a slide may not be as germane to learning as its ubiquity suggests.

This suggests projected text may possess a pedagogical function which has an inverse relationship to the quantity displayed when shown concurrently with speech.

The Guided-Imagery exercises contained cognitive load which was germane to the task in the context of engagement, but it did not appear to be germane to the task of supporting retention of the Values statements. Sweller et al. (1998) suggested germane load should be as demanding as possible in order to facilitate learning. Such a high load was apparent in the Guided-Imagery modality, and appeared to have stimulated strong engagement and recall, although the technique was not directed toward accurate retention of the phrases. However, the additional cognitive load imposed by Trad-PPt of reading and listening concurrently was not germane to the recall task, and may have created a split attention effect (Chandler & Sweller, 1991) and extraneous cognitive load (Sweller et al., 1998).

As noted above, the number of recall answers which were judged as correct increased once I broadened the range of acceptable statements to include individual interpretations. In the event, many response sheets contained one or more blank spaces, and perhaps this finding indicated that these respondents chose not to answer because they could not recall the exact words. It is possible that a higher number of correct statements and a greater proportion of positive reactions which immediately followed the attempts at recall might have been recorded if I had asked respondents to describe the Values in their own words.

A factor which may have contributed to lower statement recall among those who attended Guided-Imagery may have been my inclusion of the Values statement only at the start and finish of each task. However, this also applied to Custom-Graphics, so the impact of such a limiting factor is uncertain. Had I asked participants to use imagery to remember the Values statements themselves, it is possible some may have enlisted mnemonic strategies to aid retention of the phrases. The next section analyses differences in recall by individual value.

Recall by individual Value

Put Patients First

A high proportion of accurately recalled statements recorded for this Value may be attributable in part to the concreteness of the statement. As a metaphor, 'putting first' may have encouraged neural association with the action of physically placing a person ahead, for example in a queue, or raised on a plinth (Buccino et al., 2005; Rohrer, 2005).

The Custom-Graphics mode produced a significant number of responses which, although not accurate, reflected the image displayed; such as, '*seeing through eyes of patients*' (see hatched areas in Figure 9.9) which linked to the image that depicted a patient's-eye view of a hospital ward. Trad-PPt included the text, 'We will view our actions from the perspective of the patient' as a bulleted sub-section; yet no-one from either Trad-PPt group included this descriptor in their responses. This suggests the extra text presented in this mode provided no additional support, or if read, was not retained in long-term memory.

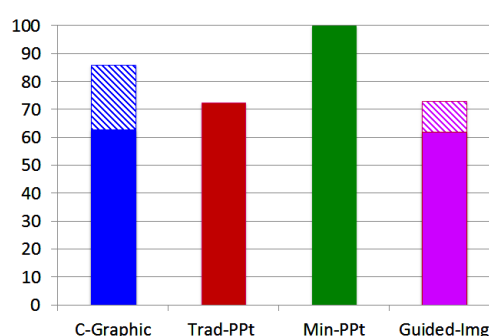


Figure 9.9. Recall by modality: Value 1. *Put Patients First* (hatched areas indicate incorrect answers which demonstrated a clearly identifiable recollection of the concept).

Our Staff Make a Difference

This Value (Figure 9.10) differed from the other statements in that it was inherently tenuous; as well as being clichéd, it did not enlarge upon what such a 'difference' might comprise. The accompanying text displayed in Trad-PPt did little to clarify this, and included nebulous statements such as 'We will be clear about responsibility', and 'We recognise that every person is different'. This Value returned the lowest results in a test of recall (Figure 9.10), although Min-PPt recipients returned over twice as many correct responses as Trad-PPt. As identified in 6.3 above, the vagueness of the Value qualifying statements for 'Our Staff Make a Difference' prompted me to add a

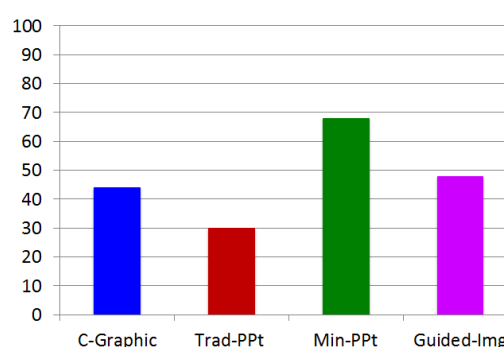


Figure 9.10. Recall by modality: Value 2. *Our Staff Make a Difference*.

story in the Trad-PPT lectures, yet despite this addition the lowest recall was recorded for this Value.

Leaders that Lead and Listen

The low scores recorded among Guided-Imagery groups for this Value (Figure 9.11) may be due in part to the fact that the statement did not form part of the imagery task. Additionally, a difficulty was experienced by some participants in attempting to imagine a manager who as the Value suggests, 'leads and listens' (see Section 9.7 below for further discussion). Conversely, the visual

alliteration of 'L's in 'Leaders that Lead and Listen' reported by some participants in the Min-PPT focus groups may account for the higher recall scores for this modality.

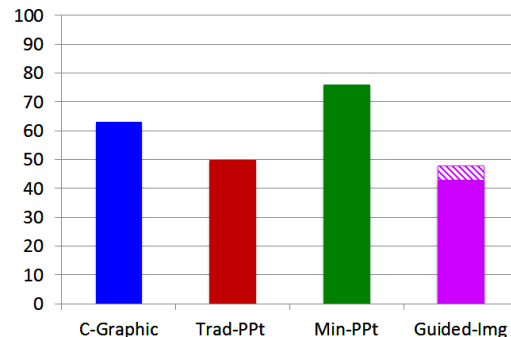


Figure 9.11. Recall by modality: Value 3. *Leaders that Lead and Listen* (hatched areas indicate incorrect answers which demonstrated a clearly identifiable recollection of the concept).

Pull Together as One Team

A serial position effect noted above for Trad-PPT (Figure 9.5), and Min-PPT (Figure 9.6), may have been disrupted in Custom-Graphics and Guided-Imagery versions by high recall scores for this particular

Value; possibly because the Custom-Graphics and Guided-Imagery aids were more effective in assisting recall for some Values. 'Pull Together as One Team' was by its nature suited to portrayal as a visual metaphor which depicted staff literally 'pulling together', and for Custom-Graphics the image of a hospital ward team pulling on a sheet was recalled easily. In the Guided-

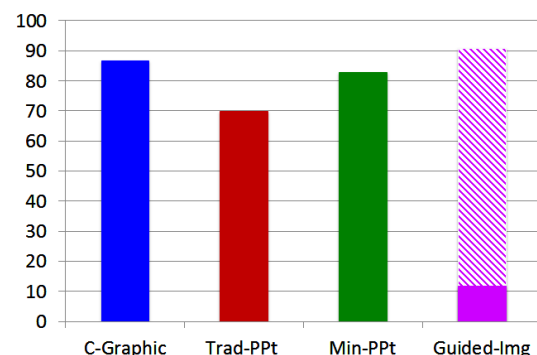


Figure 9.12. Recall by modality: Value 4. *Pull Together as One Team* (hatched areas indicate incorrect answers which demonstrated a clearly identifiable recollection of the concept).

Imagery modality, I added an analogy by drawing a comparison with ants, and when the answers including the word ants were taken into account (see hatched area Figure 9.12), it produced the highest score for this Value. In using the simple analogy of ants, I had introduced a concrete element which acted as a conceptual

peg (Paivio, 2007) on which to ‘hang’ the concept. The metaphor ‘pulling together’ may also have encouraged neural stimulation of that part of the brain which deals with the motor action of pulling, and may account for a high number of correct responses (Bergen, 2012).

Strive for the Best

For this Value, Trad-PPT produced the second highest number of correctly recalled statements (Figure 9.13) after Min-PPT, and the reasons for this are unclear. Perhaps because of its position as the final value to be presented in the lecture, the slide remained in view for several seconds once I had finished speaking, and thus provided an opportunity for the text to be read in full, or read a second time.

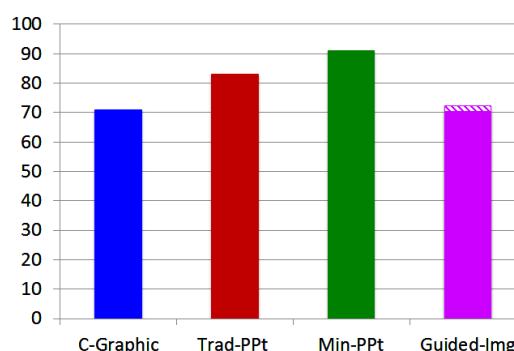


Figure 9.13. Recall by modality: Value 5: *Strive for the Best* (hatched areas indicate incorrect answers which demonstrated a clearly identifiable recollection of the concept).

Participant appreciation

I have used post-lecture evaluations based on Likert scales over many years as a means of recording learner satisfaction, and have noted that respondents sometimes display an acquiescence bias by selecting a rating toward the positive end of the scale and then repeating the choice for every question. Often this does not reflect the quality of the lecture itself, and at times may be attributable to a combination of manners and a wish not to offend the lecturer.

I held a concern before the commencement of this study that such a response might affect appreciation ratings and associated comments, and part of my rationale for providing quality biscuits for the coffee break was to encourage considered and honest answers to the questions; although it is also possible that this might have had the opposite effect and encouraged acquiescence. In the event, the numbers of responses which contained the same answer to every question varied between 20% and 2%. I interpreted this as an indication of an honest level of engagement with the questions on the part of respondents.

Participant responses to the appreciation questions are presented together for comparison in Table 9.7 below. A visual comparison of modes for each question

indicates a higher degree of appreciation overall for Custom-Graphics and Guided-Imagery, while the modes recorded for Trad-PPt tend to be least positive, with four modes recorded in Column 2, and no modes in Columns 4 or 5 for this modality.

Table 9.7 Responses to appreciation questions by intervention with modes underlined. (For Question text, see Tables 9.2-9.5).

	Custom-Graphics					Trad-PPt					Min-PPt					Guided-Imagery				
	Not 1	2	3	4	Very 5	Not 1	2	3	4	Very 5	Not 1	2	3	4	Very 5	Not 1	2	3	4	Very 5
Q i)	1	1	26	<u>46</u>	17	1	10	<u>44</u>	22	7	3	11	<u>39</u>	26	18	3	10	<u>38</u>	36	13
Q ii)	0	0	13	34	<u>44</u>	12	<u>23</u>	19	16	14	5	16	17	<u>30</u>	29	5	9	27	<u>35</u>	24
Q iii)	0	2	13	<u>39</u>	37	10	16	<u>32</u>	17	9	5	12	<u>27</u>	26	<u>27</u>	7	16	20	<u>36</u>	21
Q iv)	2	7	28	<u>30</u>	24	18	<u>26</u>	24	11	5	10	14	<u>25</u>	<u>25</u>	23	14	20	19	<u>38</u>	9
Q v)	1	5	21	<u>39</u>	25	21	<u>23</u>	<u>23</u>	14	3	22	20	<u>23</u>	19	13	4	20	18	<u>37</u>	21
Q vi)	0	4	17	<u>40</u>	30	16	<u>25</u>	18	22	3	8	11	<u>30</u>	25	23	12	15	21	<u>31</u>	21
Q vii)	1	1	14	<u>38</u>	37	12	23	<u>28</u>	17	4	6	10	<u>26</u>	34	21	9	17	24	<u>30</u>	20

A sample question was chosen for further analysis; A Kruskal-Wallis test was carried out on the recall results for Question 2 '*Did the visual aids make the lecture more interesting?*' A statistically significant difference was found between the modality groups for this question; $\chi^2(3) = 50.61$, $p = 0.000$. Custom-Graphic, Min PPt and Imagery groups recorded higher median scores ($Md = 4$) than Trad-PPt which recorded a median value of 3. A Mann-Whitney test was then carried out between the three modality pairings which included Trad-PPt in order to establish whether a significant difference existed between Trad-PPt and the three alternatives modalities.

Table 9.8 Responses to Q2 'Did the visual aids make the lecture more interesting?' by pairings with Trad-PPt

Modality pairing	<i>U</i>	<i>z</i>	<i>p</i>
Trad-PPt ($Md = 3$), Custom-Graphics ($Md = 4$),	1569.5	-6.97	.000
Trad-PPt ($Md = 3$), Min-PPt ($Md = 4$)	2892.5	-3.45	.001
Trad-PPt ($Md = 3$), Guided-Imagery ($Md = 4$)	2939.0	-3.60	.000

The results are shown in Table 9.8.

Table 9.8 indicates that, after application of a Bonferroni adjustment for the three pairings in which the significance level becomes .017, Trad-PPT was found to be significantly less appreciated than the other modality in each pairing. These findings add to reports of students' disillusionment with PowerPoint (Mann & Robinson, 2009).

In Chapter 3, I suggested the novelty effect of PowerPoint is likely to have passed by the second decade of the 21st century; although I cannot completely discount the possibility that the images used for Custom-Graphics may have been perceived as novel, and as more interesting than that which was anticipated by participants at this event. One of the focus group members may have spoken for many when he said, referring to the study day, *'I'm sure everyone looks in their diary and thinks 'Oh God'...'*, and then described having been pleasantly surprised at the approach employed in the Custom-Graphics lecture.

It was noted in Chapter 2 that many studies have found that students appreciate PowerPoint text slides, and some researchers link this finding with the provision of slide copies for later revision (Bartsch & Cobern, 2003; Savoy et al., 2009; Szabo & Hastings, 2000). In this comparison of cases, there was no anticipation of a test or examination on the part of the learners, and thus no attendant desire for notes. This reinforces the importance of the observation that detail regarding content, which was found to be absent from much of the literature, should be included in order to make valid judgements about the efficacy of visual support.

Recall and appreciation by professional registration

Participants were asked to include their professional status on the post-lecture response sheets. Results were categorised into two groups: registered staff and non-registered support staff. Registered NHS staff are educated to a minimum of Level 5 of the National Qualification Framework (NQF) and most have first degrees. Additionally they are required to maintain an on-going programme of continuing professional development as part of their role. Although some support staff may also hold qualifications of level 5 and above, the organisational requirements for such groups vary from Entry Level literacy and numeracy, to Level 3 NQF, with a small number of nursing support staff qualified to NQF Level 4. Difference in registration status was of relevance to this study, because in the course of their professional

duties and continuing professional development (CPD) registered staff are required to attend presentations supported by visual aids in which the informational visual content often comprises text, and are also required to interact with a larger amount of textual material than support staff in their everyday roles; both in the creation of records and in assimilation of patient data.

Table 9.9 Participants by registration status

Modality	Total	Non-Registered	Registered	Not supplied
Custom-Graphics	86	37	49	5
Trad-PPt	84	48	36	-
Min-PPt	93	45	48	4
Guided-Imagery	95	38	57	5

The composition of each modality group by professional registration status is shown in Table 9.9 above. The scores for each group were compared between registered and non-registered staff by carrying out a Mann-Whitney U test for each modality. The results are shown in Table 9.10.

Table 9.10 Recall scores by registration status

Custom-Graphics	Significant differences were found in recall scores between registered participants ($Md = 4$, $n = 49$) and unregistered participants ($Md = 3$, $n = 37$), $U = 661$, $z = -2.26$, $p = .024$.
Trad-PPt	No significant differences were found in recall scores between registered participants ($Md = 3$, $n = 36$) and unregistered participants ($Md = 3$, $n = 48$), $U = 782.5$, $z = -.759$, $p = .448$.
Min-PPt	Significant differences were found in recall scores between registered participants ($Md = 5$, $n = 48$) and unregistered participants ($Md = 4$, $n = 45$), $U = 815$, $z = -2.25$, $p = .025$.
Guided-Imagery	Significant differences were found in recall scores between registered participants ($Md = 4$, $n = 57$) and unregistered participants ($Md = 3$, $n = 38$), $U = 724.5$, $z = -2.79$, $p = .005$.

A significant difference ($p = .005$) was found between registered and non-registered staff in the Guided-Imagery group when corrected to include interpretations. It is possible that this finding reflected a degree of willingness for participants to follow

imagery instructions from a researcher perceived to be like themselves, as found by Richardson (1987), in that they may have identified with me as a fellow healthcare professional. The finding of significant differences between professional groups for each modality except Trad-PPt, suggests this effect might apply to other relatively novel methods.

A possible explanation for the finding that registered staff scored more highly on recall than non-registered staff, is the more frequent requirement of the former to assimilate information in the course of their roles as mentioned above. However, if this were the case, a similar result might be expected for Trad-PPt, and as can be seen from Table 9.10, no significant differences were found between registered and non-registered staff for Trad-PPt. It is unclear what might account for this finding; one possibility is that both registered and unregistered groups chose to disregard Trad-PPt slides in equal measure; another is that the redundancy effect may have applied equally to both groups.

Appreciation of modality by registration status

In order to establish whether significant differences were present between registered and unregistered staff, a Mann-Whitney test was applied to recall scores for registered and unregistered staff for each modality. The results are shown in Table 9.11 below, and it can be seen that no significant differences were found between these groups for either modality.

Table 9.11 Question 2: ‘Did VAs make lecture more interesting?’ by registration status

Custom-Graphics	No significant differences were found in recall scores between registered participants ($Md = 4, n = 49$) and unregistered participants ($Md = 5, n = 37$), $U = 852.5, z = -.52, p = .606$.
Trad-PPt	No significant differences were found in recall scores between registered participants ($Md = 3, n = 36$) and unregistered participants ($Md = 3, n = 48$), $U = 707, z = -1.45, p = .146$.
Min-PPt	No significant differences were found in recall scores between registered participants ($Md = 4, n = 48$) and unregistered participants ($Md = 4, n = 45$), $U = 852, z = -1.81, p = .070$.
Guided-Imagery	No significant differences were found in recall scores between registered participants ($Md = 4, n = 57$) and unregistered participants ($Md = 4, n = 38$), $U = 1027, z = -.44, p = .658$.

This study adds to the literature by its inclusion of non-academic participants, and the finding that participants without degree-level qualifications appear to have appreciated visual aid modalities to a similar degree to those qualified to degree level or above.

Engagement and affect

The focus groups ran for 30-40 minutes each; yet it was noticeable, both during group facilitation and later transcript analysis, that conversation which related to the design and impact of visual aids comprised a greater proportion of the conversation in the Custom-Graphics and the Guided-Imagery groups than for groups who had received text-based visual support. In the groups who attended Trad-PPt and Min-PPt, despite continued efforts on my part to steer conversation back to visual aids, more time was spent in discussion of other aspects of the lecture, such as the concept of Values in the organisation, staffing levels, and Values as '*management propaganda*'.

Attending to simultaneous speech and visual experience

All Custom-Graphics focus group participants reported they were able to listen to me and look at the images simultaneously. However, Trad-PPt participants described making a conscious choice of whether to listen to me, or to read the slides. If everyone had made such a choice at the start, there would presumably then have been no extraneous cognitive load or split attention effect (Sweller et al., 1998) which might otherwise have increased the difficulty of the task. The low recall scores of Trad-PPt suggest that some participants may not have made such a decision (or perhaps felt obliged to read that which had been presented to them), and did in fact attempt to do both. That not everyone might routinely make such a choice when presented with a lecturer and visual text, was indicated by the focus group member who described his previous experiences of reading to the accompaniment of speech in lectures as '*just torture*'.

Those who attended Min-PPt explained they found it easy to quickly read the text and then listen to me; the brief text had not presented an attentional conflict as described by Trad-PPt participants. Min-PPt focus groups expressed a preference for this modality, and results confirmed its effectiveness in aiding recall of phrases. However, the brief text was not accessible in the form of a recalled image as for

Custom-Graphics and Guided-Imagery groups; this suggests its supportive impact may be limited to the time during which it is on display.

Some Custom-Graphics group members expressed a desire for text to be displayed alongside images. However, as noted above, Min-PPT groups were unable to 'see' the text when attempting to recall the slides; so the effect of this combination on recall is unclear, and requires further research. Nonetheless, as the Min-PPT groups recalled the greatest number of accurate phrases, a combination of Graphics and Min-PPT may have returned a greater number of correct answers whilst maintaining a depth of engagement. Moreno & Mayer (2002), found the presentation of concurrent narration, text and image to increase cognitive load and to reduce the effectiveness of learning, although Mayer & Johnson (2008) suggest this effect may be negated if only a few words are used, which supports the suggestion of the focus group. This is an area which warrants more research.

It is possible that the Custom-Graphics images facilitated improved cognitive processing, although as noted by Brunken et al. (2010), it is not easy to be certain whether such an effect was brought about by an increase in germane load or a decrease in extraneous load.

Descriptive speech

A carefully chosen analogy or simile can stimulate the creation of an image, and I chose ants as an analogy in Guided-Imagery for their virtues of working tirelessly for the common good. Although I used the phrase 'like ants' only once, it created a lasting impact and was recalled by many participants; both on the recall test and in the focus groups. This suggests lecturers might make productive use of such techniques in place of visual aids, as the deployment of a pertinent simile or metaphor may stimulate visual working memory without requiring a visual depiction.

Depth of engagement

Engagement may have been enhanced in Custom-Graphics by my choice to depict staff perceived by participants as from their 'in-group' (Turner & Oakes, 1986); conversely this factor may have been reduced had I employed commercially produced images of UK healthcare workers, and reduced further still with the use of iStock photographs of US health workers (who wear significantly different clothing).

The finding that recognisable faces had a significant impact warrants further research, in order to further clarify the impact on learners of images of people who they perceive to be similar to themselves, as well as those they know personally.

The heightened level of engagement reported by Guided-Imagery participants adds to the 'Imagination Effect' finding of Leahy & Sweller (2005), in which they recorded enhanced performance when learners were instructed to imagine tasks. This study has added to these findings by the inclusion of role-related scenarios in the learning. Green & Brock (2002) suggest the effectiveness of imagery may depend on the imagery skill of the individual, and while this may intuitively seem as though it should be true, Richardson (1999) observes that when experimenter bias is removed, there is no significant difference between good and poor imagers. Nonetheless, the ease with which the subject can be visualised has been shown to have a role (Richardson, 1999). I endeavoured to make the selected scenarios easy to visualise by the provision of careful instructions and descriptions, although as noted above, not everyone was able to follow imagery instructions in the way I requested. However the focus group comments indicate that imagery was achieved in different ways. Green & Brock's (2002) suggestion with regard to the imagery skills of individuals does not take into account the imagery-inducing skill of the presenter. The way in which such an activity is facilitated may be a key factor in its efficacy, in the same way that instructions to simply 'use imagery' may produce mental models which are less vivid than those who provide instructions to create 'rich' and 'vivid' images (Denis, 1982). The findings of the Lecturers exploratory survey suggested some lecturers do employ such methodology, and the frequency with which teachers and lecturers use this technique is investigated in the Lecturers main study reported in Chapter 10.

Image recall

Participants from Custom-Graphics and Guided-Imagery focus groups were able to recall and apparently reconstitute images 90 minutes after the lecture. Recall among Guided-Imagery groups took noticeably longer than Custom-Graphics groups, although they reported being able to 'replay' the whole experience. This extra time may have been required because the image was harder to reconstruct, or possibly because they recalled scenes in the form of moving pictures which had played over

a period of several seconds, and required a similar period of time to replay. With the exception of a visual matching of 'L's in Min-PPt, this did not take place with text, despite this modality producing the highest score in phrase recall. This suggests single words may have an improved effect on recall if they are imageable. It is unclear if this applies to words of one syllable only, or whether longer words might also be recalled or reconstructed, and this is an area which warrants further research

Affect

As well as the finding that people depicted in Custom-Graphics were recognisable to many of the participants, their facial expressions appear to have added affect to the impact of the slides. This may highlight an important differential between authentic images and those obtained from commercial image sources such as iStock. For example, photographic models are able to mimic smiles, although these may appear false, and are known as 'Pan-Am smiles' after the expressions affected by staff in posters produced by the now defunct American airline (Seligman, 2002). The staff featured in Graphics mode displayed genuine 'Duchenne smiles' (Klein, 2002), in which, in addition to the corners of the mouth rising, the eyes narrow, 'crow's feet' appear, and the cheeks rise. The finding that faces known to the participants aided storage and recall as well as creating affect adds to the findings of Knobloch et al. (2003) who observed a powerful effect of pictures which contained well known faces from the media.

Gerrig (1998, p. 3) suggests a narrative '*serves to transport an experiencer away from the here and now*'. Gerrig's (1998) choice of the term 'experiencer', implies a sentient occurrence; something more profound than simply listening to or analysing a proposition. It was such an affect I aimed to achieve; I wanted learners to have an 'experience' which they constructed for themselves. I aimed for them to be transported from the 'here and now' of the lecture theatre, if only for a few moments, and for the Guided-Imagery and Custom-Graphics focus group members, the method was reported to have achieved that aim.

Re-conceptualisation arising from Custom-Graphics and Guided-Imagery

Some participants in Custom-Graphics and Guided-Imagery groups reformulated the information, and considered their own actions in the scene without having been asked to do so. For example, one member, upon seeing herself through the eyes of

a patient, had admonished herself for '*towering over*' the person to whom she was talking.

As noted in Chapter 2, the inclusion of people within an image is known to have a significant impact on direction of attention (Buswell, 1935; Yarbus, 1967). Yarbus (1967) found directional attention depended on questions asked of the observer, and I might have increased engagement with Custom-Graphics by posing specific questions which related to the images as each slide appeared.

Responses for modality appreciation were slightly less favourable for Guided-Imagery, although the focus group responses for this modality were positive. The focus groups were able to explore the impact and affect, whereas the Likert questions were answered in the setting of respondents' attempts at phrase recall only, and as has been noted above, Guided-Imagery was not found to assist accurate recall of the words. It is also possible the focus groups comprised individuals who were more inclined to engage with new approaches, such as that employed for Min-PPT. In a learning environment in which no requirement existed for further study or examination, there was little evidence found to support the use of projected comprehensive text summaries presented without temporal pauses. This suggests that in a learning environment in which a later revisiting or revising of material is required, the provision of text summaries as handouts or downloadable revision aids are likely to be helpful, while visual aids which are designed to utilise visual working memory may be more apposite to a live learning situation. One Guided-Imagery focus group member said how relieved he had been to realise it wasn't going to be text-heavy PowerPoint, explaining he felt, '*its only value is as handouts*'.

One Custom-Graphics focus group member illustrated a point which related to the lasting impact of images by providing an accurate description of a graphic visual aid I had shown during a lecture she had attended 10 years previously. The image she recalled was particularly arresting and had comprised a tiny premature baby cradled in an adult hand, and it is not easy to imagine how a text-based slide might create such a lasting memory. But that is not to say that such an image could not be created with language which comprises descriptive speech, or by guided imagery; and this notion leads towards a theory in which working memory might be utilised in

more learning situations than the literature review in Chapter 3 suggests it is at present. The next chapter seeks to establish how common such planned use of visual working memory may be among lecturers' practice.

Effect on lecturer

I did not anticipate that the visual aids would have an impact on me as a lecturer, in preparation or in delivery. Creation was significantly more demanding for the Graphics mode, and I spent approximately three days creating the Graphic slides, yet despite this large investment of time, I did not achieve the planned impact in aiding recall. The impact of Trad-PPT was to make me feel uncomfortable when I delivered this modality; I would not ordinarily use this technique but was nonetheless unprepared for the strength of feeling, which I later compared to that one might feel if wearing an item of clothing in public which was out of character.

9.8 Discussion

Images are not necessarily equal in effect

I had anticipated that the expressions of the staff depicted in Custom-Graphics images might engender a positive affect, and this was borne out by the focus group discussions, although the images themselves were not linked sufficiently closely to the Values statements to aid recall of the words. However it did achieve the desired outcome of the value statement itself, which was to engender a feeling and a sense of purpose, and to encourage those present to contemplate their professional practice.

Imagery and learning

In Custom-Graphics, what the learners saw was aided by their memories of individuals and locations depicted, whereas in Guided-Imagery the learners created images using their own memories; that they were able to do so supports the notion that the representations were drawn from long-term memory and processed in the central executive of working memory (Baddeley, 2003b). However, in one of these complex tasks, I imposed a demand which was difficult for some participants when I asked them to imagine someone who possessed attributes that for some, did not match any experience stored in their long-term memory.

Although Custom-Graphics localised the setting and provided recognisable depictions, it was obviously not possible to include all individual participants in the

images; they necessarily remained as observers of a frozen moment in time. Thus a key difference between Guided-Imagery and Custom-Graphics in this comparison of cases was that the former facilitated placement of the learner within the scenes; they were effectively customised for each person. Such self-referencing is known to have a powerful impact on encoding in long-term memory (Rogers, Kuiper, & Kirker, 1977); and in this task, participants combined self-referencing with the opportunity to mentally place themselves in the position of another, and imagine what a person might feel in such circumstances. Such an action is known to be beneficial in the development of empathy and understanding of the feelings of others (Kuipers & Clemens, 1998; McKeachie, 1986), and may also increase recall of information (DeNeve & Heppner, 1997). Guided imagery may thus have the potential to provide lecturers of suitable topics with an opportunity to create a role play in the imagination of their students, whilst allowing all learners to participate simultaneously and avoid any feeling of self-consciousness which might ordinarily occur when undertaking such an activity in front of their peers.

In Guided-Imagery, I stimulated a detailed manifestation of each Value. The effectiveness of such specific instructions suggests lecturers who wish to use this technique for relevant subject matter might optimise results by first devising a high-imagery scenario, which they then present to students in the form of instruction. As with Custom-Graphics, Guided-Imagery added to the sentience of the learning experience, although in this intervention, some participants abstracted the material further and created their own interpretation.

Descriptive speech

Broadly similar patterns of recall between each Value may be seen from a comparison of the bar charts in Figures 9.4 to 9.7. As well as the possibility of a serial position effect discussed above, this commonality may also reflect varying degrees of imageability possessed by each phrase, and which may impact upon memory independently. Descriptive and metaphorical speech employed in place of plain language may also create a powerful impact, as found in both active imagery and stories, and as noted in Chapter 2, it is known that language is capable of causing stimulation of motor areas in the brain (Bergen, 2012; Buccino et al., 2005). For example, whereas 'Our staff make the difference' does not link with movement or spatial relationship, 'Put Patients First' has a physical relationship to the embodiment

of the reader, as does 'Pull together as one team'. This suggests lecturers might aid recall by the employment of descriptive speech which is concrete, or metaphorically linked to concepts as suggested by Sadoski et al. (1993). Thibodeau & Boroditsky (2011) found that the choice of metaphor introduced early into an explanation can have a significant impact on the way in which listeners think about a topic thereafter. This is important because the planned stimulation of additional brain regions may assist storage and recall during a lecture.

The finding that Guided-Imagery produced vivid recall supports the notion that visual working memory may effectively be stimulated with the planned use of visualisation, and that in appropriate circumstances visual projection might be supplanted by such a technique. The opportunity for lecturers to utilise imagery may vary according to the nature of subjects taught, and when used may not necessarily require participants to close their eyes as in this study. This is an area that warrants further research within individual topic areas.

9.9 Conclusion

This chapter has compared four case studies which utilised different visual modalities and has shown that for lectures in which there is no requirement for future revision, the display of text-based visual aids which contain 40-60 words to support the lecturer may not be as productive for students as its ubiquity suggests once a requirement for revision and note taking is removed. However this observation does not apply to all text in such a setting, as the display of minimalist text was found to be beneficial when used to support recall of short phrases.

This chapter has shown that in order to facilitate optimal engagement with a topic, pedagogically functional images can be perceived concurrently with listening, and germane information may be added in this way. Images created in the 'mind's eye' by guided imagery may create an experience which places a learner within a relevant scene, with attendant benefits for recall and implicit learning.

The next chapter describes a series of interviews which inquire into lecturers' practice.

Chapter 10 Lecturers main study: Interviews with teachers and lecturers

10.1 Introduction

This chapter builds on the findings of the Lecturers exploratory study reported in Chapter 8, and describes an inquiry into teachers' and lecturers' practice with regard to visual aids. It presents the results of a series of semi-structured interviews undertaken with 31 teachers and lecturers from a combination of work-based and HE backgrounds. Following analysis of the transcripts, the chapter details the choices made by the participants when designing visual aids; the ways in which their visual displays are integrated into their teaching practice, and the rationales which inform their decisions. The results are discussed, and the impact on the findings of respondents whose professional role involves undergraduate and postgraduate education studies is taken into account.

10.2 Research design

In Chapter 3, I identified that detail regarding the design and content of visual aids used by teachers and lecturers in post-compulsory education is largely absent from the literature. In this study I aimed to inform the lacuna by gaining insight into lecturers practice through interviews with practitioners, and I hoped my findings might provide a catalyst for future research into this area. As far as I have been able to ascertain, this study is one of the first to inquire into how lecturers design and integrate their visual aids in their lectures since the introduction of digital media. I am aware of an online survey undertaken into this area by researchers from the University of Central Lancashire in 2010 (Morley et al., 2012), but to date this study has not been published, and my requests for access to the data have been unsuccessful.

I considered asking participants to provide samples of their visual aids, but decided such a move might have implied I wished to pass some form of judgement on them. Furthermore, had I made such a request, there would have been no guarantee that examples provided were representative of the participant's usual practice, and additionally I would not have been aware of the way in which they were combined with spoken delivery in a lecture. I elected instead to provide an opportunity for respondents to show me examples if they wished.

I considered the possibility that respondents might acquiesce and attribute reasons for their visual aid design to that which they believed they should do, rather than what they actually did. However, I decided that an assurance of anonymity, coupled with professional integrity would produce honest answers, and as far as I was able to ascertain this is what transpired. Additionally I believed such interviews offered a degree of transferability for other teachers and lecturers. I did not wish to influence respondents or lead their answers by the suggestion of reasons to use visual aids; although a 'magic wand' question, in which I asked 'If you could have creative or professional support to provide visual aids, are there some visual aids you would use that you don't currently?', was somewhat 'leading' as it suggested the interviewee might currently use visual support that was less than ideal.

Pilot

I undertook three pilot interviews in order to develop the interview questions. These comprised individual semi-structured interviews with colleagues; each of whom was a professional teacher. During these interviews I made hand written notes, and I experienced some difficulty in attempting to take notes whilst I formulated the next question. I am experienced in conducting recruitment interviews as part of a panel, where to some extent one can rely on colleagues to note that which one might have missed. However, as a lone interviewer I found the requirement to record responses whilst constructing a following question resulted in some answers going unrecorded, and I resolved to record the interviews in my next attempt. In a final pilot interview I did so, and found my ability to concentrate fully on replies and compose fresh questions to be considerably improved.

When planning the pilot I anticipated that respondents might provide a variety of pedagogical reasons for their use of visual aids, but did not find this to be the case. All three teachers who participated explained they used visual aids primarily (and in one case exclusively) to assist themselves. This finding led me to consider the possibility that a sample which comprised teachers and lecturers might not provide data as rich in information as I had hoped. In response to this result, I decided to broaden my sample to include lecturers who were engaged in teacher education and postgraduate education studies, and who I believed might employ a wider range of techniques in their use of visual aids due to their closeness to educational theory.

The pilot findings which indicated respondents used visual aids primarily for themselves led to a change in design of the main study, and I resolved to inquire separately into visual aid use that was designed specifically to assist the lecturer and that which was intended to support their students. In my first question I asked how visual aids helped the respondent and explicitly used the pronoun ‘you’, and in my second thematic question I inquired how visual aids helped their learners (for the key interview questions, see Appendix 14). In this way I separated functionality early in the conversation. The pilot results indicated that the participants, who each held a teaching qualification, had received no training in either the design or use of visual aids, and this finding, coupled with the results from the Lecturers exploratory study led to the inclusion of a question in which I asked interviewees what training they had received in this area.

In the pilot I became aware there are reasons a lecturer might use visual aids which may not arise in the discussion, for example, ‘emotional engagement’, ‘motivation’ or ‘proof’; each of which might enhance a lesson or lecture depending on its subject, and for this reason I added a question in which a list of reasons to use visual aids was offered. The

Table 10.1 ‘Possible functions of pictures in prose’ (Levin, 1981). Items in bold are considered to be the primary functions.

Function	Operating principle
1. Decoration	Increase overall attractiveness
2. Remuneration	More people will [pay to] come
3. Motivation	Increase interest in subject
4. Reiteration	Additional exposure to material
5. Representation	Makes information more concrete
6. Organisation	Makes information integrated
7. Interpretation	Makes information more comprehensible
8. Transformation	Makes information more memorable

questions (detailed in Appendix 14) were in part extrapolated from Levin (1981) list of eight ‘possible functions of pictures in prose’ (see Table 10.1). This typology originally applied to illustrations in books; however Levin’s (1981) functions also represent plausible reasons to use visual aids in a classroom, and in the absence of a typology for class and lecture room visual aids, they presented a suitable basis for the questions. These 8 functions were added to reasons to use visual aids which arose from the literature review, and additionally from my own experiences with ITT students, and produced a total of 18 possible reasons. To reduce the possibility of

acquiescence, the list was introduced once the main body of the interview had been completed. At that juncture the list was either presented or e-mailed to the respondent, dependent upon whether the conversation was conducted face to face or by telephone. Interviewees were invited to select functions which they felt applied to their personal use of visual aids. I stated beforehand that the list was not exhaustive, and explained I was also interested in any additional reasons they might be able to add.

During the pilot interviews I found that if I received only a small amount of information which related to the purpose of the interviewee's visual aids, and then offered a possible reason such as 'to help learners remember', respondents often agreed these applied to them too. Replies such as these suggested acquiescence may be a factor. It is possible the pilot respondents gave such answers in accordance with what they felt a professional should do, although it is also possible they were genuine answers and my questioning had simply failed to stimulate these thoughts. I resolved to pose these questions at the end of the interview, in the form of a list of possible reasons to use visual aids (see Appendix 15).

The pilot results suggested fifteen minutes would suffice and I added a further fifteen minutes to allow for respondents who might have more to share, and allocated approximately 30 minutes in total.

As noted above, the pilot findings led to my decision to record the interviews in the main study, and I used an Olympus DS50 digital voice recorder to do this. I asked each participant before commencement of the interview if it was acceptable to them for me to record the conversation. For the telephone interviews I connected the voice recorder to the telephone handset by means of a 'ReTell' inline adaptor. In this way I was able to record all conversations for future transcription.

Selection of a sample

It was not practical for me to interview a sufficiently large number of teachers and lecturers to include representation of all subject areas taught in post-compulsory education, so I chose as broad a selection of participants as I was able. My sample comprised 31 teaching and lecturing professionals from different subject specialisms and backgrounds. Of the total, I had met 28 at least once prior to the interviews, and had attended lectures given by 18.

The sample comprised:

- 10 Work based teachers (6 Commercial, 4 NHS)
- 8 University lecturers, ITT (University of Plymouth)
- 2 University lecturers, BSc Nursing (University of Plymouth)
- 1 University lecturer, ITT (University of St Mark & St John, Plymouth)
- 9 University lecturers (University of Exeter, Graduate School of Education)
- 1 Lecturer (London Knowledge Lab)

The eight University of Plymouth ITT lecturers taught trainees who were undertaking the Diploma in Teaching in the Lifelong Learning Sector (DTLLS), and who were employed mainly in FE and work-based teaching. Of the 31 participants, 28 possessed formal teaching qualifications.

I believed the inclusion of a purposive sample (Cohen et al., 2000) which comprised lecturers in ITT and postgraduate education studies would provide a richer source of information due to their closeness to educational theory, and to the requirement incumbent upon this group to model the pedagogical process. Maxwell (1992) confirms this to be a valid approach, and observes that making a selection from 'ideal types' whom one might expect to possess a particularly high standard of knowledge, may produce particularly illuminating findings. However, by the inclusion of teacher trainers in my sample, I may have sacrificed a degree of transferability in favour of richer information. Another factor which influenced my selection was a requirement for respondents to be available within an 80 mile radius which allowed me to recruit participants from the University of Plymouth.

One of the aims of this study was to produce guidance which would be of value to anyone who wishes to use visual aids in a lecturing or teaching environment, including lecturers in ITT. In my own experience as a lecturer in ITT, I have observed some teacher trainers who regularly use text-based visual aids in their lectures, and thus model this method for future teachers; usually without an explanation of the purpose or limitations of this modality. Informal discussions with colleagues from ITT departments around the UK suggest that, anecdotally at least, this situation may not be limited to the southwest of England. However, the diversity among my sample of 31 teachers and lecturers could not aspire to be representative of a nation of teachers, who trained at a variety of institutions, and who teach a

variety of subjects. Interviewees taught subjects which ranged through initial teacher training, post graduate education studies, leadership and management studies, and interpersonal skills, and which include significant amounts of abstract content. Many respondents used visual aids to illustrate topics which do not readily lend themselves to depiction; for example concepts such as complex systems, ontology and epistemology.

No language teachers were invited to take part because, as discussed in Chapter 1, text employed as a visual aid in this area of learning may also function as a pictorial depiction for unfamiliar word forms, and thereby blur distinctions between text and images.

10.3 Results

Five major themes emerged;

1. Reasons for using visual aids.
2. Influence of presentation software.
3. Predominance of text.
4. Influence of learning style theories.
5. Initial Teacher Training in visual aid use.

10.4 Theme 1: Reasons for using visual aids

It seems reasonable to suggest that visual aids displayed during a lecture should assist students' interpretation of that which the lecturer is elucidating. However, a theme emerged from the teachers and lecturers interviewed which suggested visual aids are often created and used for reasons other than directly helping the learner.

Three sub-themes were identified:

- i) Visual aids may be created as aids to planning,
- ii) Visual aids may possess a key function as lecturer prompts,
- iii) Visual aids may be generated primarily for pre-lecture information and aids to note-taking.

These sub-themes are analysed in more detail below.

i) Aids to planning

The first step in creating a lecture would logically be to create some form of plan, and then design the visual aids once it is known where, and in what form, visual support is required. However, for 11 teachers and lecturers interviewed in this study, the first

step in planning a lecture was to create the visual aids. A software feature is available which supports this practice; 'Slide Sorter' function in PowerPoint (and its 'Light Table' equivalent in Keynote) allows slides to be repositioned within the slideshow sequence. This facilitates the creation of a form of a digital text-based storyboard, in which the lecture planner is able to observe the effect of varying combinations of slideshow components by changing their sequence;

'I put lots of PowerPoint slides together and then I start jiggling them around so that I can see what I think works best in terms of what order things need to be said' (Jane).

A lecturer in ITT confided that although she regularly creates lesson plans, she finds,

'Sometimes it's easier to do the PowerPoint first and then do all the official stuff on the lesson plan after you've got that into place' (Daisy).

Slide Sorter view is a function which many lecturers said they found helpful, and the technique is broadly similar to the storyboarding technique used in the cinema production industry since the 1930s, in which sketches are placed beside short text summaries to map out the sequence of elements in the story (Tumminello, 2005). However, such storyboards are illustrated with drawings, and in the absence of an artist to create such sketches, this method may encourage the production of slides that express creative content in textual form; thus the text effectively becomes the 'sketch', and diagrams and images are added afterwards, if at all. From the descriptions provided by respondents of their practice, the slides are created first, and are then swapped around until a logical sequence emerges. Many respondents referred to time pressures when preparing lectures or lessons, and it appears that such storyboards, once finalised, often become the visual aid set, with no further amendments made to the design. This approach is not inevitable however, as once planning has been completed, a separate set of visual aids might then be created specifically for display during the lecture; although no-one described taking such an additional step. Whether the reason which underpins this dual functionality is solely a lack of time to create an alternative set is unclear.

ii) Lecturer prompts

A further sub-theme emerged in which it appeared that visual aids may be created to assist lecturers themselves during delivery of their lecture as a form of visual 'road

map', which at any given point reminded them where they were in the lecture plan. 11 interviewees said they used their slides as a prompt during the lecture to remind themselves what they would discuss next;

'I suppose really I use them as prompts for myself...it helps me as a prompt to remember where I am' (Jan).

One teacher included a coding system in her slides which comprised different slide transitions and also animations on individual slides; the purpose of the codes was to remind her of whereabouts she was in the lecture plan,

'if I've got a list of things I'll use chequerboard and blinds, and my last point I'll have fly in from the bottom because that tells me that's the end of the list' (Suzy).

Kosslyn (2007a) recommends the use of text on slides as a prompt during a lecture, but as Shepherd (2007) observes, such advice may lead to the predominance of text so often criticised.

The use of slides as prompts, instead of a prepared prompt sheet, may result in delayed cueing for learners, because both they and the lecturer view newly presented slides simultaneously. Slides shown in this way cannot easily provide a cue for the student (Tabachneck-Schijf & Simon, 1996), or 'signpost' the next aspect of the topic (Exley & Dennick, 2009). If a slide appears unannounced, the lecturer is likely to have missed the opportunity to cue; furthermore, if students have printed the slides prior to the lecture, their notes allow them to see the slide before the lecturer displays it. This practice may represent a contributory factor to students' unfavourable experiences of PowerPoint recorded by Burke et al. (2009) in which lecturers were found to read slides aloud as each one was introduced. The use of PowerPoint slides as prompts found in this study, combined with the findings reported in Chapter 3 that students benefit from printed notes, provide some explanation for the employment of text-based PowerPoint during a lecture. However, the notion that this may not be sufficient to assist learning, and may at times even be unhelpful to the process is discussed in Chapter 11.

Since the introduction of PowerPoint version 2007, it has been possible to operate the software in such a way as to show a view to students, which is different to that visible to the lecturer. This facility is known as 'Presenter View' in PowerPoint and its engagement produces a 'Speaker Notes' screen which is visible to the lecturer on

the laptop which runs the software, while the projector shows only the slide itself on the auditorium screen. In this way a lecturer is able to see the slide currently displayed plus accompanying notes and forthcoming slides in the sequence, and does not need to use the displayed slide as a prompt. This method provides prompts for the lecturer and facilitates associated cueing for students. However, no respondents described using this facility, although one said she was aware of the function.

iii) Pre-lecture information and aids to note-taking

Svinicki & McKeachie (2011) note that not all lecturers are convinced that making slides available before a lecture in order that students can print copies is a good idea, nonetheless many Universities encourage this practice (Exley & Dennick, 2009). Additionally, 'guided notes', in which incomplete PowerPoint text slides are provided which are designed to encourage students to complete the blanks, may be more effective in stimulation of student engagement (see for example, Austin, Lee, Thibeault, Carr, & Bailey, 2002; Biggs & Tang, 2011; Neef, McCord, & Ferreri, 2006). Only one interviewee (*Dixi*) described the provision of such a form of incomplete notes for her learners. Such guided handouts, which might be more accurately described as a learning activity than visual aids, require design (or adaptation from the original) of a slide set on the part of the lecturer to fit this purpose. Otherwise, notes which are simply a reprint of the lecturer's slides merely provide the third part of a 'triple delivery' (Parker, 2001), in which the same words are spoken, projected on a screen, and provided on paper.

One lecturer noted that handouts which have been created from comprehensive text slides used in the lecture are expected by her students, who,

'get quite narky if you don't do it' (Daphne).

Daphne suggested the practice of making slides available prior to lectures led to many of her presentations being '*text-heavy*', and in this way she felt the technology was tending to drive her lectures. *Daphne* added that every so often she did not make such a summary available, and offered her students some relevant reading instead. But she added that when she did this,

'they absolutely hate it...which annoys me to death, really' (Daphne).

The expectations of *Daphne's* undergraduate students in relation to visual aid content concurs with the findings of Burke et al. (2009) and Roehling & Trent-Brown

(2011), who recorded a benefit from the provision of text summaries to help students establish key points in lectures and to revise for examinations. Yet Neef et al. (2006) note that ready-completed sets of notes do not require active student engagement.

Daphne described her students' expectations for text,

'It's sort of become an expectation that you will in essence put the textbook up on their student portal in pieces... and it's not my job to write them a textbook' (Daphne).

The provision of completed notes in the form of printed lecture slides has an important role in revision, where the identification of all key points ensures nothing is missed in exam preparation (Armbruster, 2008), although the provision of notes in this context has a different purpose to that of visual stimulation on the part of the learner.

Of the interviewees in this sample, nine were employed as lecturers at Exeter University, which requires slide sets to be available to students via the University intranet before a lecture takes place, so that students may print the slides and bring them to the lecture as handouts. *Vicki* noted that the practice influenced the appearance of her visual aids,

'We don't provide handouts in any big lectures or any sessions, it's the students' responsibility to then print off stuff and bring it along... it makes you plan your teaching around a PowerPoint' (Vicki)

Vicki's description of planning 'around a PowerPoint' was a further indication of an incentive to use text as primary content for visual aids. Although slide sets and note-taking aids do not have to mirror each other (Austin, Lee, & Carr, 2004), 28 of the 31 respondents indicated their presentation remained unchanged when shown in the lecture itself. In fact, the technology encourages such duality by allowing a slide set to be printed in a so-called 'Handout' format, in which two or three slides are presented on each page with adjacent lines for handwritten notes.

Presentations which contain multimedia such as video clips are inherently more difficult to place online than slide sets which contain only text, and such combinations may also require specific software to be installed on the computer of a student who wishes to download the material. Additionally, such presentations also require a higher level of server capacity than text-only slides and cannot be printed in

their entirety; consequently for pre-lecture availability such elements are not usually included. *Jane* described a difference between the presentation slides that she placed online pre-lecture and the visual aids she used during her lectures,

‘Generally there are things happening in my PowerPoint...and obviously I need to take those things out when I’m putting stuff online. So my PowerPoint for online reference is just a text, whereas my PowerPoint that I give has video in it, and audio or transcript, stuff like that...’ (Jane).

Mike said he felt some university lecturers created a ‘deadening’ effect among their students by the way in which they speak to their slides during lectures; he suggested there was often a difference in approach evident among lecturers, notably,

‘between the people who have taught in classrooms and people who just taught students, and sometimes the people who just taught students will almost read their notes’ (Mike)

Mike’s observations accord with the those of Young (2004) and Burke et al. (2009) who found undergraduate students reported a tendency for their lecturers to read from slides. The requirement to produce slides as pre-lecture notes, and an associated expectation for such presentations to be comprehensible in themselves (Kosslyn et al., 2012), may have created a significant impact on visual aid design.

This theme suggests that for some respondents, visual aids are often created and displayed for reasons other than to aid student understanding during lectures.

10.5 Theme 2: Influence of presentation software

The descriptive term used most commonly by interviewees for their visual aids was ‘PowerPoint’. Although this proprietary eponym refers to the presentation element of the Microsoft Office suite, the term is often used to describe any digital projection driven by a computer in support of a lecture, and the term has now largely replaced the late 20th century name ‘overheads’ which referred to acetate sheets.

In order to fill the lacuna in the literature created by previous studies in which data regarding design and content of visual aids was absent (see for example, Apperson et al., 2006; Bartsch & Cobern, 2003; Craig & Amernic, 2006), I encouraged interviewees to talk specifically about the content design and style of their visual aids.

With one exception, all participants used PowerPoint software to create their visual aids, and the remaining lecturer used Apple Keynote. Although Apple Keynote and Microsoft PowerPoint contain differences in design, these relate primarily to the creation of slides, and for the purposes of this research the end product is not significantly affected by the choice of software. This notion is supported by Tufte in his frequently cited essay *The Cognitive Style of PowerPoint* (Tufte, 2006), in which he writes that the title could just as well have been '*The Cognitive Style of Slideware*' since most of the problems he attributes to PowerPoint apply equally well to Keynote.

Two sub-themes emerged which related to the influence of presentation software;

- i) An influence on design by readymade PowerPoint templates
- ii) The use of slide backgrounds from the PowerPoint library

i) PowerPoint templates

An anecdote relates how a traveller, who seeks directions from an old man at the side of the road, receives a reply along the lines of, 'Well, if you wish to go there, you don't really want to start from here'. In line with this aphorism, it might be argued that the default setting of PowerPoint situates the user in a place which is not an ideal starting point; yet it in this study, many teachers and lecturers described commencement of their lecture planning by using the opening text template which is automatically provided. On creation of a new slide set in PowerPoint, the user is presented with two boxes, one of which offers the instruction 'Click to add title' and below that, the request, 'Click to add subtitle'. Then, upon creating a second slide, the software automatically produces another instruction to 'Click to add title', with a subordinate text box ready-bulleted, and an additional command to 'Click to add text'. Such commands encourage the creation of slide sets based on text.

PowerPoint was initially conceived for the business world (Gaskins, 2007) and as Adams (2006) observes, teachers and lecturers do not have to follow the layouts provided, yet many respondents in this study indicated that they do so. 10 of the interviewees described how they used the PowerPoint readymade template function to create their slides, and explained that this saved time when creating a lecture. One interviewee explained that she used templates because she had taught herself

to use the software, and was aware that her limited knowledge restricted the creativity she was able to bring to her visual aids,

'People like me make do with, 'Oh I'll teach myself to use this' and then you don't ever get to the point where you can be really creative because you're stuck within the technology and the templates' (Katharine).

Another teacher explained that she used templates,

'because I don't know how to do it any other way' (Lauren).

Although the creator of a slide set is under no obligation to use such templates, for time-pressured lecturers, some of whom may have to prepare lectures in their own time, this study has found that many may take this route. This finding adds to Tufte's (2006) criticisms of PowerPoint default template, which he suggests most users automatically follow when creating slides, rather than design their own. As described in Chapter 3, Tufte (2006) believes that NASA engineers' adherence to PowerPoint templates and their associated indenting system contributed to a space shuttle disaster. Lecturers may similarly risk presenting a distortion of relative importance due to PowerPoint's indenting system (although presumably without such catastrophic consequences).

ii) Ready-made backgrounds

As well as providing a user with templates, PowerPoint software offers a choice of ready-made backgrounds for slides which, once selected, then appear on every slide. Many free backgrounds are also available on the Internet. 17 respondents reported that they used ready-made backgrounds, and two described how they selected backgrounds that related to their subjects,

'If I have a background, I like it in some way...either to be visually attractive, a sort of aesthetic thing or...it might be that it's got a kind of clue in it ... there used to be one in PowerPoint that had a notepad spiral bound thing... because my research is in writing, I often use that simply because it links in with the notion of writing, it's like a pad turning' (Dixi).

Tom described how he chooses backgrounds with specific purposes in mind (see Figure 10.1), and links the slide background with his topic,

'there are two favourites... it's blue and down in the right-hand corner it looks as if you're looking down on ripples, someone has dropped a pebble into a pond ... which I think is a nice little metaphor, because I'll very often sort of tap into people's subconscious and mention that, you know, sometimes learning a point will be like dropping a pebble into a



Figure 10.1 PowerPoint background used by Tom to subliminally suggest an ocean.

pond and the ripples will lead you to other thoughts and other ways of using the material. There's another one I'll use which is effectively an ocean, but it's pretty subtle so it doesn't really look like a picture of an ocean unless you look at it clearly...and so again I'll just sort of have that drip feeding into people's attention... by using words like, what's over the horizon... again, I hope that becomes a little metaphor that sort of burrows its way into people's brains.
(Tom)

Dixi and *Tom*'s approach is in accordance with advice provided by Kosslyn (2007a) to use backgrounds which resonate with the subject matter. However, Tufte (1983) disagrees, and has coined the phrase '*Chartjunk*' (Tufte, 1983, p. 113) to describe extraneous information such as relevant images placed as a background to a graph, which he believes distracts from the primary information. Whether such backgrounds offer added interest or distraction to learners is unclear, and *Tom* and *Dixi* were the only respondents who described the regular employment of such an approach for their students. *Kara* had experimented with photographic backgrounds which she had created herself, although she had done so only for adults with learning difficulties, and this perhaps reinforced a notion referred to in Chapter 4, that for students who do not have an identified learning difficulty, images may not be as valuable. Nonetheless, the impact of carefully chosen backgrounds to text-based slides warrants further research.

This theme suggests that for some teachers and lecturers, presentation software characteristics may sometimes have a greater influence on visual aid design than pedagogical rationales.

10.6 Theme 3: Predominance of text

A theme emerged which indicated that many respondents relied heavily upon text as a visual aid. A contrast between a personal ideal and practice was illustrated by *Richard*, who initially said,

'I don't think I... use PowerPoint much to be honest...'

Later in the interview, *Richard* described the format of his visual aids,

'This is a kind of typical structure for me, the background to the issue that I'm concerned with, and that will be done in a series of headings, subheadings, then it'll have a series of bullet points, then I'll speak to those, then I'll...I've got something which kind of goes through maybe the arguments, and again bullet pointed, two or three bullet points on each page'.

Richard's description was representative of many responses received during the interviews, in that he described the presentation of a linear progression of textual information, to which he lectured.

Laurillard (2002, p. 21) suggests that '*Academics want students to learn more than that which is available from experiencing the world*' and by definition this cannot easily be represented visually. Possible representations include a model, a visual metaphor, or an analogy; yet this may be the point at which teachers who have limited preparation time resort to the use of a textual summary. University lecturers who teach courses which contain content that is abstract in nature, may not have a bank of readily availability images as, for example, lecturers in science-based subject areas might do. *Tom* noted,

'You think of the way medics use visuals...twice now when I've been to a doctor or a dentist they turned on a computer and said 'look at this ...' and they've shown me a picture, they've shown me a diagram...very, very useful' (Tom).

A contributory factor to the selection of text as a visual aid may be that, as suggested by Willard (1973), academics think primarily in language due their predisposition to express their thoughts in this medium. Lecturers are by definition presumed to be highly literate and articulate, but (aside from those engaged in the arts) whether they are 'visually' literate, in the sense that they are able to express themselves visually is less clear.

Three respondents showed me a representative slide set during the face to face interviews, and two telephone respondents sent me presentations after the interview; of these, four were text-based and one included some images. Six respondents explained that they attempted to keep their text as brief as possible, and used the term *'bullet points'*, as both a literal description of indented style, and a generic term for text summaries. Of those who replied that they mixed text with images, a similar pattern emerged to that described by *Richard* above, in that further questioning revealed greater use of text than first intimated. The use of text was justified by some respondents who expressed a feeling that simple images may not be appropriate for an educated audience. For example,

'When you're teaching at postgraduate level, it almost makes it seem a bit silly, doesn't it? ...kind of dumbed down, really' (Jan)

However, one lecturer echoed the undervaluing of images discussed in Chapter 4, *'I think images are immensely important, but somehow they don't fit into the academic concept very easily, in the way that art is sort of driven to the corner'. (Mike)*

These responses provide insight into the reasons which may lie behind the selection of text, and perhaps also into a lack of appreciation of how images might be used in the teaching of abstract topics.

14 respondents said their visual aids comprised *'mainly text'*, and 12 others described their visual aids as comprising a mixture of text and graphics, for example,

'I try to combine text with visual images because I think they often help students; they act as an aide memoir' (Elly)

'PowerPoint with bullet points and images that relate to the topic in each slide if possible' (Daisy).

Seven interviewees did not provide sufficiently detailed descriptions to be certain whether or not they used images. However, for those who replied that they designed slides with a mixture of text and images, it is possible they may not have used as many images in reality as their answers suggested. I had attended lectures delivered by 18 of the interviewees, and was able to remember the style of their visual aids on those occasions. Yet in some interviews, I became aware of a mismatch between the descriptions provided by the interviewee, and the visuals I recalled them displaying during their lecture; namely that they were much more text

oriented than their answers implied. At the same time, I felt confident from the tone and openness with which everyone answered my questions that they had responded in a frank and honest way. I was initially at a loss to explain this observation, and during the interviews in question, could think of no way of addressing this disparity without appearing to doubt the integrity of their answers, and I did not pursue this particular avenue of questioning.

On reflection, a possible reason for this disparity may be that the amount of time these lecturers had invested in the creation of graphic slides, for example in planning the design, finding and selecting images, and creating diagrams, was proportionally greater than that spent creating text slides (note that for the Modalities main study, the Custom-Graphics variant required much longer to create than the text versions). In their recollection of the experience, it is possible the disproportionate amount of time required to create image-based visual aids left an impression of greater use of this medium than was actually the case. It is also possible that more time was spent interacting with graphic and diagrammatic slides than with text during the lecture itself, and this also may have supported a sense that graphics were used more frequently than was actually the case. For future research, it may be insightful to investigate whether a similar distortion might apply to students' memories of time devoted to the display of graphics in lectures compared with that spent on text.

Differences between what lecturers say and what they do in practice were recorded by Kane, Sandretto, & Heath (2002). They contend that research into teaching beliefs and practices of university lecturers which examines what they say and does not directly observe what they do, risks '*only telling half the story*' (Kane et al., 2002, p. 177). Murray & MacDonald (1997) also recorded differences between lecturers' beliefs and the methods used. That such differences may exist was a possibility I pondered when planning the interviews, however Kane et al. (2002) and Murray & MacDonald (1997) studied lecturers who had no teaching background prior to their university appointment. In my study, many of the lecturers had been employed as school teachers in the past, and were also involved in undergraduate and postgraduate education studies; as such they might be expected to have a greater awareness of their own teaching practice. Nonetheless, both groups would presumably be equally likely to find themselves under pressure of time, and the

speed and ease with which text-based slides can be created may remain a common factor.

As well as aids to note taking, text on a screen was found to serve other roles,

'When I've got groups working on tasks they can look back up on the screen to see what the task I set was' (Keely).

One lecturer indicated that as a learner,

'I like to have at least two sources of information so if I forget to listen I can at least look, you know, what did they say or I can catch it up on the visual aid' (Raphael).

In this context, text slides offer an opportunity to replay the lecturer's words, rather as one might pause and replay a section of audio or video on a computer to listen again to something that was unclear, or if, as suggested by *Raphael*, one loses concentration. It may also be that when employed in support of complex subjects, students might welcome the opportunity to examine the content a second time,

'I tend to use a bit more text now than I would like to because of student feedback...I have had some feedback where students have suggested that it would be more helpful if what I was saying was actually written' (Dorothy).

This is relevant because *Dorothy's* topics include concepts which may be quite challenging to assimilate for her students (for example, complex systems), in which it is likely they might appreciate a second opportunity to comprehend her words.

However she did not indicate whether these comments had emanated from students for whom English is a second language, and this may also be a factor.

It could be argued that when 'catching up' by reading a slide as recalled by *Raphael*, the learner is not attending to that which is currently being articulated, and then will then need to catch up with that section by reading, and then miss the following spoken element, and so on. This was found by Adams (2006), who recorded students' descriptions of the experience of missing that which a lecturer had just said, because they were reading a slide still on display from a previous point. The provision of text to support students whose concentration has strayed may be a helpful technique in a carefully paced lecture, but it is not a visual aid in the sense that it directly aids comprehension; in this instance the text could be described as taking the role of a lecture room 'iPlayer', in that it allows the student to 'replay' the content, although possibly to the detriment of the point currently enunciated.

Jane explained that she sometimes used text slides to assist students for whom English was a second language. The University at which she lectures enrolls many such students, who may appreciate provision of a text summary; however this thesis has identified that native English speakers may experience difficulty in reading if the lecturer is enunciating the ensuing point, so the task of simultaneous reading and listening may place even greater competing demands on students for whom English is not their first language. The term 'reverse redundancy effect' (Toh et al., 2010) has been proposed, to describe a situation in which the presentation of redundant text assists, rather than hinders learning for such students. However, the findings of the Modalities main study suggest such an effect may only apply if a lecturer allows discrete temporal pauses for the reading of text slides in order to avoid the presentation of competing attentional demands.

Two respondents described an inventive use of text on a lecture slide which transcended the textual-image divide. *Raphael* described a slide which he had created to support Jacques Derrida's deliberate misspelling of '*différence*', as '*différance*'. *Raphael* explained how he had animated the errant 'a' so that it increased in size to a more prominent placement on the slide. The use of text in this way is known as 'kinetic typography' (Lee, Forlizzi, & Hudson, 2002), and although it is not commonly seen in lectures, represents a mode which is designed to create a memorable impact for the learner at the time of the lecture. *Dalia* mentioned she had recently attended a lecture delivered by Lawrence Lessig (on whose design Min-Ppt was based in the Modalities Main study) in which she recalled his most memorable slide as one which simply contained a single large '@', and that she could still 'see' the slide.

This theme indicates that text features frequently as a visual aid in its own right, although often without a rationale based in pedagogical or psychological theory.

10.7 Theme 4: Influence of learning style theories

As described in Chapter 2, the Visual, Auditory, Kinaesthetic (VAK) model of learning styles has not gone unchallenged in the education world, yet it remains popular nonetheless (Sharp et al., 2008). In this study the impact of VAK was apparent among work-based teachers, and among some ITT lecturers. Five ITT lecturers referred to VAK in their responses, and indicated the pervasive appeal of this model

may extend beyond primary teachers into post-compulsory education. I did not mention the terms 'visual', 'auditory', or 'kinaesthetic' in any of my interview questions, yet the phrase 'visual learner' was used by 13 respondents. For example,

'A lot of people are visual learners...and so diagrams are particularly helpful'
(Daphne)

A belief that diagrams and images would be appreciated primarily by 'visual learners' was evident among respondents who used the term, and this was linked to the provision of images specifically for those with such a preference. As discussed in Chapter 2, contradictory indications exist with regard to what a visual aid for such a learner should comprise. Charles articulated such a concern:

'There's this thing about, you've got to use something visual...people sort of stick random pictures in...and I think, that's not a visual aid, it's just a picture'
(Charles)

Charles' comment reflects the findings of Mayer & Gallini (1990) reported in Chapter 2, that illustrations which are merely representative of a topic and not designed to aid understanding do not necessarily aid learning.

Notwithstanding the comments above, a difference in opinion with regard to learning styles was apparent among respondents. 17 interviewees indicated they did not consider styles when they planned their visual aids, of whom 7 were emphatic in this regard. One lecturer expressed his feelings sufficiently strongly that, despite saying I could quote him, I felt obliged to censor his reply:

'It's total - - - - - . It's over simplistic and it's dangerous. I spend a lot of time contradicting what is taught in colleges about learning styles'
(Richard)

'I feel quite strongly about it, ... it comes back to this... misunderstanding of these learning styles... people who've got this stupid sort of VAK stuff...'
(Charles)

'If you mean by learning styles the separation of a learner into being a visual, auditory, kinaesthetic, logico-spatial, intrapersonal...over my dead body...'
(Dixi)

It is noteworthy that of the seven lecturers who expressed disdain towards the application of learning styles, six were lecturers from the same university campus, and all were engaged in postgraduate education. In the Lecturers exploratory study

described in Chapter 8, lecturers engaged in nurse education, and those who lectured in post-compulsory ITT did not present such a stance.

Paradoxically, two interviewees who expressed a strong professional dislike of the concept of learning styles used the term 'visual learner' with reference to themselves; *Dixi* said,

'I'm very aware that I am a visual learner, but I am also aware that if I am a visual learner, the fact that I'm not auditory is a weakness' (Dixi),

and *Max*,

'...it may be just the way my mind works but...I am quite a visual learner so I like to see things myself but I like things in order, or pockets, or groups' (Max).

Their responses provide insight because they illuminate the degree to which the concept of a 'visual learner' may have entered the educational lexicon.

This theme indicates that for some teachers and lecturers, the concept of 'a visual preference' as a learner trait may influence their use of visual aids in general and of graphics in particular.

10.8 Theme 5: Initial Teacher Training in visual aid use

When they described their design and use of visual aids, only five respondents provided responses which suggested they planned visual aids primarily to meet the needs of their students. No-one referred to WMT, CLT or DCT, and their visual aid use appeared not to have any foundation in such theories. This suggested the teachers and lecturers in this sample may have received minimal training in the use of visual aids, and with the exception of two university lecturers trained outside the UK, and one NHS teacher, this transpired to be the case.

Richard expressed a concern that trainee teachers sometimes produce visual aids primarily to satisfy a requirement that 'something' is on display during their observed lessons, but without necessarily having an educational purpose,

'I go and watch [trainee] FE teachers as part of my role... they tend to produce things [visual aids] simply because they think they have to, because that's what they're told they have to do in the FE context, and I'm saying, well what was the purpose of it, did it serve any purpose? Did it help the students learn or was it just to satisfy some kind of external scrutiny that you're subjected to?' (Richard)

Jan expressed her feeling that,

'There's...an expectation that if something is at a professional level, you have to have a PowerPoint'. (Jan)

In answer to the question 'Can you remember what tuition you received specifically about visual aid use when you took your original teaching qualification?' 18 teachers and lecturers replied they had received none, and some emphasised this strongly,

'B....r all is the answer; absolutely nothing, nothing whatsoever.' (Suzi)

Jane and *Keely* recalled having received training in the use of visual aids, and it is significant that these two lecturers had earlier described their deployment of a broad selection of visual techniques in their lectures; they utilised images, cartoons and videos to accompany their teaching. *Jane* had undertaken a postgraduate teaching qualification outside the UK, and she explained the technical skills of teaching had comprised a discrete part of the syllabus. *Keely* also trained outside of the UK and visual aids had formed a formal part of her teacher training. *Keely* taught undergraduate primary teachers and specialised in religious education, and said that as well as using visual images for her students, she also used methods that were,

'something that I'd be modelling for them to use in the classroom' (Keely).

Only one respondent who trained in the UK reported receiving tuition in the use of visual aids during her ITT; *Katherine* recalled a tutor who was extremely keen on the area of visual aids, although it was *Katherine's* recollection that this was her tutor's personal interest and the subject was not formally included in the syllabus. It appears that the tuition received by *Jane*, *Keely* and *Katherine* had encouraged them to engage with and explore the practice of visual support in a more active way than teachers who had received no such input.

Tom and *Jan* reported having received some guidance in visual aid use but that it had been restricted to technical information which related to operation of the hardware and software. *Tom* indicated his had been limited to advice such as,

'Don't read from the screen; don't stand in front of the machine' (Tom)

Tom and *Jan* had also received basic advice with regard to font sizes and the number of words to display on a screen. The difference between the ability to create a text-based slide, and that required to design a visual aid which adds to the spoken word, may represent a difference between digital literacy and visual literacy. That

this aspect of visual creativity may be lacking in the world of business presentations is perhaps understandable, as presenters at such meetings would presumably not consider themselves to be teachers. However, the finding that a limitation in such skills may exist in the world of education suggests a contributory factor may lie within the ITT curriculum.

Among those who reported having received no training in the area of visual aids, two respondents (*Mike* and *Dixi*) described how they planned and designed their visual aids carefully. *Mike* made significant use of photographs and images, and he attributed his skill in this area to his background in photography and theatre. *Dixi* had no grounding in the visual arts, neither had she received any tuition in the use of visual aids, yet her descriptions indicated that she visually supported her lectures in a rich variety of ways. *Dixi's* description of her practice resonated with me as it mirrored my own approach (I do not have an arts background, and have received no tuition in visual aid design beyond an instruction to reveal lines of text on an acetate sheet described in Chapter 1) and it is possible that a larger sample might have found other lecturers who were similarly self-motivated.

The finding that a large proportion of teachers and lecturers in my sample had received little or no guidance on visual aid use during their ITT was unexpected and the reasons are unclear, particularly as these individuals had undertaken their ITT in a variety of institutions across the UK over a 30 year period (1970s to 2004). One possibility is that their ITT trainers may not have received guidance in this area either, and the findings of Yilmazel-Sahin (2009) in the USA that some teacher educators modelled visual aid practice which entailed reading aloud from slides, may apply in this study to some extent.

It is unclear why teachers and lecturers who received no tuition in the use of visual aids had not subsequently taught themselves, as had *Dixi* and I, and also *Lily* who was undertaking her own learning in the area of designing visual aids, for example, she described learning about the photographic '*rule of thirds*' in order to make her visuals more aesthetically pleasing. The reasons which underlie such differences in approach are unclear, and warrant further research in order to establish why some lecturers develop such skills independently, whilst others appear not to. It is also unclear why other pedagogical and instructional knowledge had not informed their

practice. It is possible that tuition in the role of, for example, working memory in learning, which might have informed such choices, was also absent from ITT. The degree to which visual aid guidance was found to have been absent in ITT among participants in this study provides cause for concern and warrants a wider geographical study.

Two respondents explained they included text-based visual aids to ‘reinforce’ learning,

‘It’s important to say that I don’t always use visual aids. But when I do use them it’s purely reinforcement of the key points, and it is that visual reinforcement of very much the key points...that I want to get over’ (Ray).

‘The main reason I use visual aids ... to complement the teaching and break up narrative ... and also to reinforce the learning’ (Lauren).

The Oxford English Dictionary defines ‘reinforcement’ as:

‘to strengthen; to make more resistant or fixed; to make stronger, strengthen (especially something immaterial); to provide with additional support’.
(OED, 2011)

However, in the arena of education and psychology, the term ‘reinforcement’ is generally used in the context of behaviourism and operant conditioning, in which the term denotes the provision of positive feedback or reward to a learner, with the aim of reinforcing the desired behaviour (Miller, 1964). Most of interviewees in this study who were employed in the arena of education studies would presumably have been cognisant with such an interpretation, and this may be the reason they did not use the term. Ray’s visual aids comprised redundant text summaries, and it is likely that he and Lauren (who were work-based teachers) referred to repetition in a different modality in accordance with the notion that extra exposure to material results in increased retention, as outlined by Sweller (2005) and noted in Chapter 2.

This is not to suggest that this use of the verb ‘reinforce’ in the sense of strengthening learning is necessarily fallacious in an education context; for example, Harthan (1981) suggests a function of illustration is to ‘amplify’ meaning. Other terms used by respondents included ‘embed’ and ‘hook’,

*‘helps embed ... the point that I’m trying to get across’ and
‘gives them something as a hook to remember later on’ (Leanne).*

The use of metaphors based on physical attachment, or an increase in volume as suggested by the verb 'amplify', support a notion that embellishment in a different format is a positive aid to learning. However, as noted in Chapter 2, if such iteration only comprises textual iteration of the spoken word, the presence of a redundancy effect (Sweller, 2005) may reduce, rather than reinforce learning.

One lecturer in ITT (*Max*) described how, during his own teacher training, he once enlisted support from a fellow student who was an artist,

'The guy living opposite me ...was an artist, an illustrator and I was teaching business studies and I needed some diagrams to help me explain 'cam-down' which is a system like trucks moving through a factory...and I can remember him drawing me some diagrams but... they were well drawn diagrams ... but actually ... it didn't add anything to the explanation'. (Max)

This experience, in which *Max* had commissioned a professionally made visual aid, but which had not achieved its purpose, had left a lasting impression, and I asked him if he had ever used this approach again. Perhaps surprisingly for someone employed as a lecturer in ITT, he never had. It is possible that if *Max* had achieved the desired outcome for his custom-made visual aid, the experience might have encouraged him to continue with the practice. Equally, if *Max* had received more guidance and support in relation to visual aids during his own ITT, it is possible he may have been able to analyse the experience and learn from what had happened in that lesson.

The finding that most teachers and lecturers interviewed in this study did not produce visual aids which were specifically designed to aid learning during their lectures does not necessarily suggest they were content with this situation, or that they would not appreciate help from an expert if one were available. Twenty interviewees indicated they would take advantage of such assistance to enhance their visual aids if it were available; although it should be noted that approximately half of these affirmative responses were based on a desire to be more technically competent in the operation of computer software and hardware. This response and the selections from the proffered list of possible reasons to use visual aids (see Appendix 15), further supported the notion that many teachers and lecturers would like to be able to create

and display visual aids which are more supportive and impactful than those they currently employ.

However, it was interesting to note that despite the finding that two thirds of interviewees reported they would appreciate the creative and technical assistance of someone well versed in producing visual aids, two (*Vicki* and *Ray*) replied they would not take advantage of such assistance if offered; *Vicki* said she felt that in such an event, *'it wouldn't be me'*.

Despite the observations noted above regarding an absence of visual aid training in ITT, 22 respondents reported that they regularly used imagery, for example by asking their students to imagine themselves in a given situation relevant to the topic. Three also explained that they regularly used image-generating analogies, although no-one described the employment of directed imagery in the form employed in the Guided-Imagery intervention reported in Chapter 9.

Theme 5 indicates the for most respondents in this study, Initial Teacher Training provided little or no theoretical foundation on which to base their design and use of visual aids.

10.9 Responses to 'Possible reasons to use visual aids'

The pilot prepared me for the possibility that teachers and lecturers may use visual aids for themselves as much as for their learners, and this was found to be the case among my sample. One respondent disclosed,

'I make the PowerPoint for me first and then for the audience – I know it sounds terrible, but it's like that!' (*Jane*)

It was for this reason that I presented the list of possible uses of a visual aid at the end of the interview (Appendix 15); I believe had I presented it earlier, respondents may have felt some obligation to include at least some of the learner-oriented reasons provided by the proffered list in their own explanations. In the event, this section of the interview always produced additional reasons to use visual aids to those provided up to that point, and the results are shown in Appendix 16.

24 respondents selected 'Provide a structure and sequence', and 22 chose 'Integrates/organises information', which supports the responses reported in Section 9.4 above. Interestingly, 22 indicated their visual aids were designed to 'Make things

more understandable', although this was not expanded upon. 'Emotion' was cited by 18 of the 31 lecturers as a reason for which they sometimes used visual aids. It is known that the presence of an emotion element enhances storage in long-term memory (Cahill et al., 1996; Medford et al., 2005), and although emotion might not feature in the teaching of all topics, all of the lecturers interviewed in the main study were involved in teaching subjects in which human interactions are fundamental. Interestingly, given the iterative nature of text-based visual aids, only eight respondents selected 'Extra exposure to material'.

10.10 Discussion

The themes identified in this chapter were not specific to any gender, workplace or profession; for example no significant differences were found between the visual aid practices which were identifiable with the respondents' teaching environment. The sole commonality observed in any grouping was a strong disparagement for theory which related to 'VAK' learning styles among lecturers engaged in post-graduate education.

This Chapter has added to the knowledge of how post-compulsory teachers and lecturers use visual aids, and as far as I am aware, has been one of the first of its kind in the UK. It has raised further questions; in particular with regard to whether the teaching of design and use of visual aids are included ITT, and warrants further research in order to establish how widespread this situation may be.

10.11 Conclusion

This chapter has described the results of a series of interviews which inquired into the way in which post-compulsory teachers and lecturers design and display their visual aids. It outlines how the choices made by some lecturers were found to be driven by motives more personal than the support of students' comprehension. The chapter established a link between a lack of training in this area during ITT, and the practice of displaying visual aids which comprise a textual iteration of speech, and which serve as a prompt for lecturers. The findings suggest this situation may have prevailed for several decades.

The following chapter discusses the findings from the studies undertaken in this thesis, and considers the implications of their results in the context of the literature reviews.

Chapter 11 General Discussion

11.1 Introduction

This chapter presents a discussion of the main findings of the studies undertaken in this thesis and relates these to the research questions and the literature review. It discusses the validity of textual and non-textual methods in a lecture setting. Two approaches to visual aid use are proposed for further investigation in lecture environments, of which the second is a guiding principle which may encourage post-compulsory teachers and lecturers to optimise use of the visual medium. The chapter also proposes the inclusion of visual 'production literacy' in initial teacher education, and the development of an online facility to support the design of visual aids.

11.2 Text as an adjunct to speech

My first research question sought insight into the impact of the simultaneous provision of speech and text upon student learning in lectures. A review of the literature suggested the use of this technique may be common practice in post-compulsory education (see for example, Burke et al., 2009; Kosslyn et al., 2012; Yilmazel-Sahin, 2009; Young, 2004), and this notion was borne out by the findings of the Lecturers main study. In the Modalities exploratory study I found the impact on recall of text summaries which are displayed concurrently with speech was not significantly different to that created by images which were relevant but only decorative; in that neither appeared to assist recall. In the Modalities main study I found 40-60 word text summaries were significantly less effective in aiding recall than images which were educationally functional, although this result was reversed when the text summaries were reduced to 3-5 words only.

In both Modalities studies, participants indicated a preference for images over text summaries. Although the Trad-PPt slides used in each study contained relevant information in a clearly legible format, this modality was found to be the least appreciated, and in the main study it produced the lowest affective impact.

Textual iteration as a visual aid to learning

Trad-PPt slides contained the most comprehensive information, but did not produce enhancement of recall, or of affective engagement when compared with the alternative modalities used. This may be explained by working memory theory

(WMT) (Baddeley & Hitch, 1974) which suggests the provision of text concurrently with speech may compete for limited processing capacity of the phonological loop (Baddeley, 2003a). This suggestion is supported by the language processing model proposed by Gazzaniga et al. (2009) (see Figure 2.11) in which reading and auditory language comprehension share a common processing route. Additionally, attempting to imagine a concept whilst simultaneously reading has been shown to be more demanding than undertaking the same task whilst listening to speech (De Beni & Moe, 2003; Mousavi et al., 1995).

However, as discussed in Chapter 2, positive effects have been recorded for simultaneous presentation of speech and text where individually presented single-syllable words are accompanied by speech (Lewandowsky & Kobus, 1993; Penney, 1989). The role of working memory in the processing of short phrases simultaneously with speech as displayed in Min-PPT in the Modalities main study, is less clear. The lecturer's speech did not appear to compete for attention when text was displayed in this format; perhaps because participants were able to process the shorter text within natural pauses contained in speech; pauses which may naturally be lengthened when lecturing.

Trad-PPT focus group members reported that they attempted to attend to both my speech and the text, which accords with the predictions of Sadoski & Paivio (2004) and Mayer (2001) that learners would switch back and forth between the two sources. The difficulty they experienced in attempting to attend to both suggests the presentation of text-heavy slides may have created extraneous cognitive load (Chandler & Sweller, 1991).

In both modalities studies, the display of Trad-PPT may have produced a redundancy effect (Kalyuga et al., 1998) due to the conflict of attentional demands created by the lecturer and visual aid. Although I did not provide a control group in the modalities studies, each Min-PPT slide contained only 3-5 key words compared with the corresponding Trad-PPT slides which each contained 40-60 words. The removal of 90% of Trad-PPT text left only the titles remaining in Min-PPT, and this may account for the improved impact recorded, as the redundancy effect predicts removal of redundant material will result in improved processing (Kalyuga et al., 1998). Min-PPT text was also redundant to speech, yet did not appear to create any negative impact;

perhaps because there was no attempt by learners to shuttle between the two information sources (Sadoski & Paivio, 2004). Additionally, Min-PPt created minimal requirement for eye movement, and thus reduced the likelihood of such actions causing interference with the visuo-spatial element of working memory (Rummer et al., 2010).

Participants in Trad-PPt focus groups reported making a conscious choice to listen to me and not to read the displayed text; yet if all participants had made a similar decision, the low recall score could not be explained by a redundancy effect, because the redundant modality would have been effectively excluded. A possible explanation for this finding may be that the method of self-selection employed to recruit focus groups produced a sample who possessed a relatively high level of confidence, and who had independently chosen to ignore the text. In this scenario, other less decisive participants may have attempted to read and listen throughout the lecture, resulting in 'PowerPoint overload' (Yilmazel-Sahin, 2009).

The notion that a redundancy effect was brought about by the display of Trad-PPt is supported by a further finding. Registered staff obtained significantly higher recall scores than non-registered participants among Guided-imagery, Custom-Graphics, and Min-PPt lectures, but no significant difference in scores was recorded between registered and non-registered staff for Trad-PPt. The higher scores recorded by registered staff might be explained by their professional roles which regularly require the assimilation and application of new information, but this does not account for the lack of variation in score recorded for Trad-PPt. Registered staff obtain a large amount of data from textual sources in the course of their work with patients, and one might expect this skill to be transferable to the acquisition of information presented as on-screen text. So it is unclear why registered staff scored no higher than non-registered staff for Trad-PPt. One possibility is that a redundancy effect applied to both registered and non-registered staff in equal measure, whereas the other modalities did not contain completely redundant information (Severin, 1967), or in the case of Min-PPt, insufficient redundant material to have an effect.

The extent to which short phrases which comprise words of one or two syllables as displayed in Min-PPt are able to be retained visually in memory is not clear; focus group participants reported they were unable to see phrases sufficiently clearly to

'read' them again. Logie et al. (2000) found experimental subjects were able to visually recall words which comprised three letters, whereas the largest element Min-PPt participants described being able to recall were the alliterative 'L's in the phrase 'Leaders that Lead and Listen'. This suggests single words which comprise only three letters as displayed by Logie et al. (2000), may approach the maximum amount of text that can be reconstituted in the 'mind's eye' in a form that is readable. If so, this may account in part for the popularity of the Takahashi method in which a single character is displayed on a slide (Reynolds, 2005b); a notion supported by the visual recall of a slide which contained the '@' symbol by *Dalia* in the Lecturers main study.

In Chapter 2, I noted the cognitive theory of multimedia learning (CTML) (Mayer, 2005b) and the integrated model of text and picture comprehension (ITPC) (Schnotz, 2005) are not completely clear in relation to whether speech and text are able to be processed simultaneously, and if so, how this might be achieved. The lower recall scores recorded for Trad-PPt, and participants' reported difficulties in listening and reading simultaneously do not support Mayer's (2005b) proposal that a dual-channel system allows concurrent processing of two modes of language, at least not for longer sections of text. However, the higher recall scores recorded for Min-PPt suggest this may be possible for short phrases. This area warrants further research in order to clarify the relationship between simultaneous reading and listening; in particular, to establish the amount of visual text which requires provision of temporal pauses to avoid creation of a split attention effect (Chandler & Sweller, 1991) between the lecturer and text.

The findings of this inquiry suggest the commonly employed technique of delivering concurrent speech and text may have a limited efficacy. Lecturers, who presumably would ordinarily not consider speaking at the same time as a colleague addressed their students, may create an attentional conflict of a similar degree by speaking whilst students attempt to read projected text summaries. The notion that the simultaneous presentation of text with speech is efficacious as visual support for learning may be an argumentum ad populum; the fact that large numbers of such slides may be shown across the developed world (Tufte, 2006) does not, in itself, justify the practice. The aphorism 'less is more' is often incorporated in guidance for the inclusion of text in PowerPoint slides (Garber, 2010; Schnotz, 2005), yet the literature review and Lecturers main study suggest for many, the reality may be that

'more is more', despite the availability of research-based knowledge to the contrary for over 50 years (Sweller, 2005).

The amount of text displayed in Min-PPt was comparable in magnitude to sequentially exposed lines of script often employed in lectures supported by OHT in the 1970s and 1980s, and the findings of this study suggest such displays may have produced a more tempered visual support than contemporary text-heavy digital displays. Yet, as described by *Daphne* in the Lecturers main study, it may be that for 21st century students also, more text appears to provide more educational value. The numbers of lecturers who employ a speech and redundant text methodology may be large, with a commensurately large number of students who experience this modality. Although the results of this study are not directly generalisable to the 310,000 students who enter HE each year (Bollington, 2012), reports in the literature (Adesope & Nesbit, 2012; Kosslyn et al., 2012; Mann & Robinson, 2009), and the findings of the Lecturers main study suggest a sufficiently large number may experience lectures delivered this way to warrant a further inquiry into the efficacy of this practice.

The time required to create the text-based slides for the Modalities exploratory study was approximately that suggested as sufficient for university lecturers to plan their lectures by Chiddick et al. (1997); namely three times that of the lecture duration. The Trad-PPt set created for the Modalities main study required less time due to its availability in text form; however, had I not been able to copy and paste the content into slides, it would have required a similar expenditure of time. The 3:1 ratio did not allow for planning time before creating the slides, and by creating Trad-PPt in such a short time, I unwittingly vindicated the practice of planning a lecture simultaneously with creation of a visual aid set.

The above observations concern the de facto standard of the concurrent provision of speech and visual text, and are not intended to criticise the display of text per se. In Section 10.8 below I propose a methodology for the provision of text-based visual aids with a student-centred emphasis and minimal cognitive interference, and which warrants further investigation.

11.3 Images and impact

My second research question asked what non-textual visual aids might be used to support the delivery of abstract topics in a lecture environment. The findings of the Modalities exploratory study did not support the suggestion that learning is assisted by relevant images per se (Dunn & Dunn, 1993; Smith, 1996), but the results did indicate that appreciation of the modality may nonetheless be a factor that impacts upon learner engagement. Participants in both Trad-PPT and Net-Graphics groups in the Modalities exploratory study expressed a preference for images over text; despite the finding that images produced no improvement in recall among the Net-Graphics group. As described in Chapter 2, such images may hinder mental model construction for high-knowledge learners (Kalyuga et al., 2003), and thus perhaps hold the mind 'in chains' as suggested by Goethe (Gombrich, 1978). The degree of benefit which might be brought about by the inclusion of images in a lecture simply because they are appreciated is not clear, as Stafford (1997, p. 6) suggests academics may judge such images as being, '*somewhere between decoration and titillation*' (Stafford, 1997, p. 6).

Nonetheless, it is not certain that the display of images for interest alone is necessarily frivolous; Koeber (2005) notes that even when the provision of colourful digital presentations does not result in improvements to grades, it can improve student attitudes toward the course and its lecturers, and may also encourage students to take other courses from the same faculty. It is possible that a student presented with the choice of either attending a lecture or reading the relevant slides online, may be more motivated to attend a lecture which is perceived as containing interest. For example, during the lecture delivered in the Modalities exploratory study, it is possible that I created a motivation among Net-Graphics participants to attend another of my lectures; an effect which appreciation scores suggest is less likely to have applied to those who attended Trad-PPT.

The Modalities studies identified a difference in impact upon learners between images which were provided for relevant decorative support in the exploratory study, and those designed for a specific educational purpose in the main study. DCT suggests information is stored more effectively, and is also more easily retrieved if it is dual coded (Paivio, 1971), although the theory does not support the iteration of language-based information with images if the verbal material has already been

dual coded. The Modalities exploratory study found relevant but unnecessary illustrations did not aid recall, possibly because the lecture content was largely concrete in nature and thus already dual coded (Paivio, 1982; Prabu & Jagdeep, 1998). It is also possible that the presence of unnecessary illustrations created an expertise reversal effect (Kalyuga et al., 2003), in which their provision interfered with the ability of participants to create their own mental models, and to some extent this finding supports a reluctance to use images expressed by two HE-based respondents in the Lecturers main study. However the Custom-Graphics images shown in the Modalities main study were carefully designed to complement the spoken delivery and as such were task-appropriate (Schnotz & Bannert, 2003) and not redundant; these images may thus have facilitated dual coding by the provision of a non-verbal representation.

The Custom-Graphics images were found to have supported the desired outcome in terms of affect; nonetheless, the recall results obtained for 'Our staff make the difference' in this modality were lower than for the other Values. I had originally intended to show a visual depiction of this phrase in which Lego figures were portrayed in the act of constructing the word 'difference' out of pieces of plastic, i.e. literally making a 'difference'. Such a visual metaphor might have facilitated dual-coding of the phrase, however the coding that took place with the photograph employed in the study dual-coded the affective aspect instead. Similarly, for the phrase 'Pull together as one team', I considered displaying a stock photograph which depicted several hands pulling on a rope instead of the group of ward staff. Such an image may have aided recall, but from the descriptions provided by the Custom-Graphics focus groups, the affect and depth of engagement would have been absent.

Engagement among Custom-Graphics participants was found to be closely linked to recognisable faces, uniforms, locations, and the facial expressions of those depicted (Knobloch et al., 2003; Yarbus, 1967). A photographic depiction of a relevant, real-life situation is likely to provide information in addition to its associated spoken delivery during a lecture; as such a well prepared image is unlikely to be 'informationally equivalent' to language (Tabachneck-Schijf & Simon, 1996), and it is debatable whether a carefully crafted depiction can create a true redundancy effect (Severin, 1967). In Chapter 2, I described how in Charles Dickens' later career, his

illustrators were said to be unable to add to his narrative due to the author's skill in the deployment of descriptive writing (Cohen, 1980), and the possibility that a similar observation might be applied to a skilled lecturer who utilises descriptive speech cannot be discounted. It is also important to note, as described in Chapter 2, that the display of an image which adds nothing extra to that which can readily be imagined, may create a negative impact by interfering with students' mental model production (Schnotz, 2005), and may create an expertise reversal effect (Kalyuga et al., 2003) if its depiction is not required by high-knowledge learners.

Custom-Graphics images required significantly more preparation time than the other variants, and I would have been unable to complete the task if I had been restricted to a 3-1 ratio of preparation to lecture time recommended by Chiddick et al. (1997), or an additional 50% of time over that required for text slides as allowed by Bartsch & Cobern (2003). I was able to justify the expenditure of time because the modality was to be shown again in a further 50 lectures over the following two years; although it is possible that for many teachers and lecturers such a task would have to be undertaken in personal time. If the only alternative to text available to a lecturer with limited resources is a selection from a clipart cartoon library or from an Internet image search, such pictures may understandably be regarded as somewhat facile (Kress & van Leeuwen, 2006; Sless, 1981). As outlined in Chapter 4, images have a long history during which they have been considered of little value as mediators of intellectual content (Dimopoulos et al., 2003; Fleming, 1962; Mitchell, 1986), and this may underpin comments from two respondents in the Lecturers main study, who expressed a feeling that the display of images represented a 'dumbing down' of the HE process.

Notwithstanding the above observation, it might be observed that an irony resides in the debate around the use of images in HE; in Chapter 2, I related descriptions of lecturers reading aloud from slides to their students (Burke et al., 2009; Young, 2004), yet one might assume students to have outgrown a desire for information to be read aloud to them long before they outgrew a need for images in their education. Additionally, as noted in Chapter 2, an increased receptiveness towards images has been found among mature learners (Ally et al., 2008; Whitehouse et al., 2006). Thus an automatic disparagement of images among post-compulsory educators may not be justified.

HE often involves the teaching of abstract concepts which need to be grounded in experience and practice before they can be abstracted (Laurillard, 2002), and the Modalities main study has shown that it is here that a lecturer might make a choice of supporting speech with a carefully selected image, and thus provide a focal point for discussion in the form of 'heuristic sketches' (Eppler & Burkhard, 2006).

Regeneration of images

Custom-Graphics focus group participants were able to recall the images which had been displayed during the lecture 90 minutes earlier. This suggests carefully designed images may support student engagement by the facilitation of reconstructions for inspection in the 'mind's eye' later in a lecture (Damasio, 1994). However this is not guaranteed, particularly for abstract topics in which poor outcomes have been recorded following their representation by pictorial methods (Pippert & Moore, 1999; Prabu & Jagdeep, 1998). Prabu & Jagdeep (1998) suggest their poor results may have been due to participants expending insufficient effort in the pursuance of images, and the time I devoted to the planning and creation of functional visual representations for Custom-Graphics may represent an uncommon approach.

Preparation time need not necessarily be prohibitive however, if instead of creating digital depictions, a lecturer plans to stimulate the production of images in the minds of students, and this is discussed in the following section.

11.4 Guided imagery as a visual aid

My third research question inquired whether the visual modality could be enlisted to support learning without the provision of 'something to look at'. The question was inspired by reports in the literature of a confabulation of imagined memories with real recollections among experimental subjects (Dallet & Wilcox, 1968; Intraub & Hoffman, 1992; Johnson & Raye, 1981; Peeck, 1989). The question was further motivated by an unexpected outcome in the Modalities exploratory study, in which a verbally described scene was recalled by two participants as an image projected during the lecture. In the Modalities main study, Guided-Imagery included no retinally acquired images and instead incorporated instructions for participants to imagine scenes; some of which placed the individual participants in the scene itself. Although this modality created limited impact on phrase recall, it engendered a high

degree of engagement and affect which satisfied that element of the required learning outcome.

I provided detailed guidance during the imagery tasks; following an initial statement of the Value, participants were provided with on-going verbal instructions to support their visualisation of each scene. This approach differed from studies in which participants were required to form an image of their choice to represent a given word or scene (see for example, Richardson, 1985). Guided-Imagery thus ensured the continued production of 'top-down' images (Kosslyn, 2007b), and included an element of role play (Kuipers & Clemens, 1998; McKeachie, 1986) by placing participants within the imagined scenarios.

Enhanced learning is likely to occur when imagery imposes a high cognitive load (Leahy & Sweller, 2008), and for those who described their experiences in the Guided-Imagery focus groups, engagement appears to have taken place at a level in which they were absorbed by the scene; some appeared to undergo a transportation-imagery effect in which they lost a sense of awareness of their surroundings (Green & Brock, 2002). The high cognitive load was thus germane to the task, as opposed to that introduced by the difficult but extraneous task of reading whilst listening. Additionally, the imagination effect (Leahy & Sweller, 2008) brought about by the use of this technique appeared to produce a deeper affect than the Custom-Graphics images.

Although differences were reported in the way in which individuals placed themselves in the Guided-Imagery scenarios, all focus group members agreed they had been able to complete the tasks in a meaningful and realistic way. When they described the experience, participants appeared to reconstruct the images in front of their eyes, rather as Damasio (2006) describes in his analogy with the appearance of the village of Brigadoon. This accords with the observation of Richardson (1999) that instructions to use mental imagery generally result in improvements in performance in the case of high-imagery material. The results suggest that although many debates around imagery may remain to be resolved (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013), their resolution is not essential for lecturers to utilise this method as an aid to learning for topics in which personal interactions occur; for example in education, and health and social care.

The Guided-Imagery task was not expected by participants, and attendees at such events frequently experience traditional presentations which are supported by text. As such, a fresh approach might have resulted in some reluctance to participate; the finding that it did not do so may be explained in part by the observations of Richardson (1987), who noted instructions to use imagery were more effective when they emanated from an experimenter perceived to be from the same social class as the subjects. Richardson & Rossan (1994) later recorded a similar association when experimenter and subjects were similar in age. Richardson (1999) concludes subjects are inclined to take an experimental task more seriously if the experimenter is perceived to be like themselves in age or social class, and although my participants were of mixed ages, I was well known to them and was, to some extent, a member of their 'in-group' (Turner & Oakes, 1986). This connection may have supported their willingness to participate fully and follow my instructions, although this may limit transferability to a lecture environment, in which not all lecturers share such commonalities with their students. In this vein, I am unable to completely discount the possibility that there may have been an element of social desirability present, in which the imagery was described as vivid in order to please the researcher (Di Vesta et al., 1971), although the level of descriptive detail participants were able to provide suggest this was unlikely.

As noted in Chapter 2, researchers have been able to create false memories in experimental subjects by the fabrication of photographic 'evidence' which produced a belief among some participants that they had experienced situations in which they had not actually been present (Wade et al., 2002). I considered the possibility that the Guided-Imagery tasks may have created a similar impact by the placement of participants in the imagined scenes which may have encouraged 'reality errors' (Johnson & Raye, 1981). However, alluring as the notion may appear, this is unlikely as mental images which are created intentionally have been shown to be less likely to be remembered as real than those created incidentally; presumably because participants link them with the memory of being provided with instructions (Durso & Johnson, 1980; Intraub & Hoffman, 1992). Additionally, individuals are less likely to remember such memories as real if the task of memorising was difficult (Finke, Johnson, & Shyi, 1988). The imagery I stimulated in this study was both

intentional and demanding for participants, so the creation of false memories is deemed unlikely in this case.

The Guided-Imagery tasks employed in this study were closely related to individuals' employment and possessed a high element-interactivity effect (Leahy & Sweller, 2005), furthermore, participants indicated they would be able to draw the imagined scenes, which suggested that a residual image remained. Further research may be warranted which investigates the potential of this method to impact upon work-related attitudes such as those addressed in the Modalities main study, in order to establish whether lasting effects may be obtained which are comparable with those recorded for sporting performance (Woolfolk et al., 1985).

11.5 Lecturers' practice and student requirements

My fourth research question inquired into the way in which post-compulsory teachers and lecturers design and use visual aids. I found that among the participants in the Lecturers main study, most reported the employment of visual aids primarily for themselves; as a planning tool and as prompts during a lecture. Such lecturer-orientated functions influenced their design choices, and resulted in the creation of slide sets in which text featured prominently. For some, design choices were also linked to a university requirement for visual aids to be available to students online before lectures.

Maxwell (1992) suggested the inclusion of experts or 'ideal types' in research groups might be particularly illuminating, and my ideal types were lecturers involved in education studies. However, the finding that this group employed text-based slides in a similar manner to that of work-based teachers was largely unexpected. Kosslyn et al. (2012) found no significant difference between the design of presentations created within education, government and business, yet one might anticipate differences in practice would be evident between such groups and lecturers engaged in ITT and education studies, due to the latter being closer to educational theory. This finding is not easily explained, and it is possible that visual support for learning does not form part of educational theory as it is taught in ITT, at least for post-compulsory education, and this notion is discussed in Section 10.6 below. Even if this is the case, it remains unclear why knowledge of other models of memory and comprehension have not influenced practice among those involved in education

studies, and this is also an area which warrants further investigation, in order to establish the extent to which teachers and lecturers are aware of theories such as WMT and CLT.

The findings of the Lecturers main study add to those of Evans et al. (1987) in which Canadian teachers were found to rarely consider the educational functions of illustrations, and of Yilmazel-Sahin (2009) in which teacher trainers in America were found to read aloud from slides to their student teachers. It is unclear whether the practice of presenting text summaries concurrently with speech during a lecture is limited to English speaking countries. In the Lecturers main study, two lecturers who undertook education studies in Holland and Ireland respectively reported having received discrete instruction in the use of the visual medium, and additionally it has been observed that visual studies play a greater role in German speaking countries and Scandinavia than other western countries (Elkins, 2008). A comparative study which investigates visual aid guidance contained in the ITT curricula of other countries may provide a more complete picture.

The finding that most lecturers interviewed in the main study used visual aids primarily for themselves does not in itself represent a criticism of their practice. Even though their visual aid design may be influenced by such considerations, the practice supports an overall aim of delivering an informative lecture to their students. It may be that a gap in knowledge created by an absence of visual aid training in ITT has inexorably been filled by an approach based on the needs of the lecturer, and this notion is discussed in Section 10.6 below. More research is required to establish whether lecturers would produce visual aid sets differentiated for the disparate tasks of pre-lecture reading, lecture support, and revision if they possessed a more comprehensive understanding of the impact upon learning of the visual medium.

Adesope & Nesbit (2012) suggest teachers lack empirical evidence and guidance with regard to the use of speech and redundant text, and this was borne out in both Lecturers studies. Such a lack of available guidance may have resulted in an undue reliance on presentational software, and the findings of these investigations indicate software characteristics may influence lecturers' visual aid design; as noted in Chapter 3, upon creation of a new slide, PowerPoint offers a text template as the primary option. It is possible that such design emphasis on textual content, coupled

with a preference among lecturers to use the software as a planning tool, has been a primary influence on practice.

As described in Chapter 3, Clarke (1983) believed educational researchers should not compare different forms of learning media without taking learning content into account, because he felt the media does not, in and of itself, influence the learning. However, the findings of the Lecturers main study support the conclusions of the literature review in Chapter 3, and suggest the employment of PowerPoint does influence content. It may therefore be more apposite to suggest the medium 'need' not influence learning; because for some lecturers, the demands of planning, a requirement to place slide sets online before lectures, and the ease with which text may be placed into templates, have resulted in the creation of visual aid sets which may not always represent optimal use of the visual modality. Thus, with regard to Clarke's (1983) analogy in which he compared the medium with 'trucks' and learning content with an edible 'load', it might be argued that although the medium need not influence the 'nutrition' received by students, it has in fact done so. A contributory factor may be an absence of guidance provided in ITT, and this is discussed in the following section.

11.6 Visual aid guidance available to teachers and lecturers

My penultimate research question inquired into influences upon teachers' and lecturers' visual aid practice. The findings of the Lecturers exploratory study suggested that knowledge with regard to visual aid design and use varies among post-compulsory educators; and many respondents displayed a limited knowledge of this modality. The Lecturers main study found most participants had received no tuition or guidance in the arena of visual aids beyond the operation of presentation software, and this offers some insight into Berk's (2011) observation that such research as is available in the arena of PowerPoint and associated digital displays is not reflected in classroom practice.

A contributory factor to the findings which relate to lecturers' knowledge may be a lack of available resources which might assist them to develop their skills in this area. The literature review in Chapter 2 identified a small number of books available on the topic of the visual support of learning, although these were found not to be widely available in educational libraries. Conversely, many online resources which

are readily accessible were found to provide advice of questionable provenance. Additionally, many lecturers did not appear to have explored visual aid design beyond the provision of text summaries, and more research is required to establish whether theories such as WMT, CLT which might inform such choices, are included in ITT. Meanwhile theories such as the VARK styles model of Fleming & Mills (1992), and associated concepts which espouse the notion of 'visual' learners may continue to influence visual aid practice, even though the validity of such models and their application in the lecture room remain unclear (Sharp et al., 2008).

It is over 50 years since reports identified that the presentation of redundant stimuli was not congruent with learning (Mondfrans & Travers, 1964; Severin, 1967), and the Lecturers main study has found this may remain unknown amongst some contemporary teachers and lecturers. It is possible the situation also prevails in contemporary ITT, and the redundancy effect, which Sweller (2005) suggests has been forgotten and rediscovered many times, may currently reside outside of the awareness of some teachers and lecturers.

Many lecturers possess televisions which offer a variety of visual information in their homes, and most contemporary lecture rooms contain similarly sophisticated media devices which are able to display a wide variety of visual content. Yet unlike producers of television and film, teachers and lecturers are required to produce materials for a similar medium, but for which many have received little tuition or preparation. In Chapter 4, I discussed visual literacy in the context of 'production literacy' (Messaris, 1994), and suggested a low regard for the visual modality outside of the arts and entertainment media may be a contributory factor to a dearth of non-textual input in post-compulsory education. The finding in the Lecturers main study that tuition in such visual 'production literacy' was absent from the ITT of many respondents, adds to the small number of existing studies undertaken outside the UK (Miller & Eilam, 2008; Pena & Quilez, 2001; Roth et al., 1998), and links with the findings of Yilmazel-Sahin (2009) in the US with regard to teacher trainers' practice. The finding also supports the notion of Vallance & Towndrow (2007) that the educationally developed use of instructional technology may not be routinely modelled by ITT lecturers.

Despite the above observations, it is possible that some teachers and lecturers who have not received guidance in the use of visual aids may not feel no commensurate creative deficiency, because although 20 respondents indicated they would take advantage of expert help if offered, of these, half indicated they would do so in order to increase their skill in operating the software. If teachers are not provided with specific guidance, they tend to utilise new innovations in accordance with their own practice (Konigs et al., 2007), and it is not clear how change might best be initiated in this area. House (1973) suggests the communication of educational research findings depends on the effective translation of findings to the reader's personal experience, yet it has been noted that much of that which has been discovered about learning and memory has not transferred into education practices (Berk, 2011; Harkin, 2005; Roediger, 2013). If, as advocated by the film directors George Lucas (Daly, 2004) and Martin Scorsese (Cruickshank, 2006), teachers are to be cognisant of communication techniques through the visual medium, the addition of such an element the ITT curriculum may be required.

The role of instructional technologists

One avenue for change is the possibility that relationships between lecturers and instructional technologists might be developed with a view to the latter supporting the creation of pedagogically purposeful visual aids. Green (2006) observes that instructional technologists show a willingness to in assist in the creation of teaching materials, but notes some lecturers feel their skills relate chiefly to the hardware. This observation accords with two respondents in the Lecturers main study who indicated they would not wish to have another person design key elements of their lectures, and the degree to which lecturers would accept support of this nature remains uncertain.

Financial restrictions may also restrict such an aspiration, as funding cuts have resulted in a reduction of IT technical support in English universities of 6% between the years 2009-10 and 2011-12 (Gibrey, 2013). Nonetheless, the involvement of support staff in the creation of visual support for lectures remains a valid proposition given lecturers' limited resources and preparation time, and it may prove instructive to undertake a trial in which instructional technologists are provided with training to enable them to create visual support linked to planned teaching outcomes.

Resource provision

Although there is currently no armamentarium of pedagogical content knowledge (Shulman, 1986) available in the UK, such a concept need not be unattainable; existing facilities might be adapted and used as a resource to help teachers and lecturers plan and create visual support. For example, the web-based *Periodic Table of Visualisation* (Lengler & Eppler, 2007) outlined in Chapter 2, would be suitable for inclusion in such a repository.

Another resource which might be adapted is the *Learning Designer* (Laurillard et al., 2012). This free software package is designed to help teachers design and plan lessons and courses, and offers a variety of methods and learning components. For example, if a teacher wishes to choose an objective for a lesson, they may select from a variety of options available in an 'objectives palette'. This comprehensive tool does not currently address the element of visual support. An adaptation of the Learning Designer might be created in which a 'visual aid palette' is added to the software. A lecturer would then be able to choose from a selection of visual representations, which might include guidance for the incorporation of text in a non-redundant mode, as proposed in Section 10.7 below.

Given the widespread adoption of PowerPoint in educational establishments, an extension or 'plugin' for this software might be developed to facilitate the design of student-centred visual aids (and a similar adaptation for Keynote). Provision of such a plugin might encourage differentiation between the disparate components of lecture planning, pre-lecture notes, visual support, and revision notes, and complement the suggestion above with regard to the 'Learning Designer'.

In Chapter 3, I linked the integration of presentation software in class and lecture rooms over the last two decades to the notion that such new technologies offer 'extensions' to human senses (McLuhan, 1964). McLuhan (1964) suggested that a corollary impact of such extensions is to bring about 'amputations' due to skills which then become redundant. It might be argued that the introduction of PowerPoint and Keynote has produced such an amputation among many teachers and lecturers with regard to the creation of visual communications. However, because the Lecturers exploratory study found knowledge of visual aid creation to be limited, and the Lecturers main study reported many had received no training in the design and use

of the medium; a more accurate metaphor might be to suggest that for some, rather than an amputation, presentation software has highlighted a limb which is present, but which has been flaccid since the pre-digital age. Moves which might commence rehabilitation of such a metaphorical limb are proposed in the following sections of this chapter.

11.7 A student-centred approach to text

My final research question asked what forms of visual aids teachers and lecturers of post-compulsory students should consider using. The criticisms of the concurrent speech-and-text technique presented in this chapter do not lead to a conclusion that all text-based displays are inherently unhelpful. As noted above, I did not provide pauses of sufficient duration for participants to read the text on Trad-PPT slides in either of the Modalities studies. Although detail which relates to the provision or otherwise of such pauses is absent from much of the literature, this was in accordance with the practice I had observed among 18 of the participants in the Lecturers' main survey whose lecturers I had attended. The introduction of temporal pauses forms part of a proposal described below, which is offered as a basis for further research into the display of text as a visual aid.

The provision of temporal breaks in speech to allow students to read text-based displays might be analogised to the action of looking at a summary of key points whilst reading a book; in doing so, one necessarily stops reading the current section of text in order to focus on a different element of script. Such judicious direction of attention may not create a redundancy effect (Sweller, 2005), and as noted in the literature review and also one of the participants in the Lecturers main study, students appreciate an opportunity to pause and reflect by reading over key points of that which has been enunciated, but do not wish to miss the next point spoken by the lecturer (Adams, 2006).

Such a provision might be made without a redundancy effect by the expedience of allowing temporal pauses in which students are able to read and reflect on text. This approach could be combined with carefully designed differential phrasing of key points in the text, for example by the insertion of synonyms to reduce redundancy (Yue et al., 2013). Additionally, the creation of visual cognitive dissonance (Morley et al., 2012) described in Chapter 2, and outlined by *Dixi* in the Lecturers main study,

may provide germane cognitive load for both verbal and non-verbal components of working memory.

Adoption of the above method would not obviate the use of presentation software to plan a lecture, to place pre-lecture slides online, or to provide slide printouts for notes. However, such an adaptation would impact on the employment of slides as prompts for the lecturer; a difficulty which might be avoided by the use of the 'presenter view' function available in PowerPoint ('presenter display' in Keynote) described in Chapter 10, to provide prompts and advance notice of slides.

Short phrases as employed in Min-PPT may have a role in lecture topics where a requirement exists for phrases, names, dates, and formulae to be memorised by students. The combination of a minimalist-text technique and the planned exposure of text summaries described above may represent an optimal use of this medium, although the use of the minimalist mode may be perceived as over-simplistic by students unfamiliar with its function, and require an explanatory introduction. Text-based advance organisers (Ausubel, 1960) which are presented before commencement of a particular topic might similarly be optimised in their impact by the provision of sufficient time to read the content. In this way, the presentation of text need not represent an 'illusion' of extra material (Creed, 2001).

A student-centred approach as outlined above should minimise extraneous cognitive load, and represent a move toward the reduction of student disaffection attributed to the use of PowerPoint described by Mann & Robinson (2009). Additionally it should reduce the possibility that textual displays might interfere with the creation of mental models (Mousavi et al., 1995; Schnotz, 2005). However it would not in itself impact upon a potentially underutilised cognitive capacity which remains in visual working memory, and this is addressed in the following section.

11.8 A principle to optimise students' working memory in lectures

The 19th century suggestion that the addition of a visual medium to a classroom was comparable to doubling the number of teachers (Bumstead, 1841), may have been more than mere rhetoric; the notion that such an increase in learning might be achieved by the provision of a visual medium is borne out by the literature review in Chapter 2, and by the findings of the Modalities main study. Although neither the literature nor this thesis suggest a 'doubling' of capacity is possible, an additional

and frequently underutilised element of processing capacity may nonetheless be fruitfully employed by the planned inclusion of the visual medium. In the literature review in Chapter 2, I identified that the pedagogically relevant utilisation of visual working memory might optimise students' mental processing capability (Baddeley, 2003a; Mayer, 2009; Mousavi et al., 1995; Schnotz & Kurschner, 2007; van Merriënboer & Sweller, 2010). The findings of the Modalities main study also support the suggestion that non-verbal working memory may be productively utilised by the provision of educationally functional 'bottom up' visual displays, or by 'top-down' images and models stimulated in students' own minds.

To encapsulate these findings, I propose a 'Visual Working Memory Utilisation' principle (VWMU), which states that students' mental processing ability may be optimised by planning to engage both verbal and non-verbal elements of working memory when teaching and lecturing. The VWMU principle states that in order to optimise germane processing during learning, teachers and lecturers should engage the non-verbal working memory of their students concurrently with their verbal working memory by the planned provision of visual aids, or stimulation of images and models from memories and schemas internal to the learners. The principle of VWMU thus ensures germane cognitive load is maximised (Schnotz, 2005; Sweller et al., 1998). The provision of text-heavy visual aids concurrently with speech violates the principle by expending visual working memory capacity in the processing of redundant text (Baddeley, 2003a). The provision of a text-heavy visual aid simultaneously with speech which attempts to summon a mental image, also violates the principle due to the possibility that such a display may interfere with the production of mental models (Mousavi et al., 1995). However the display of minimalist text may accord with the principle by minimising such demand. The principle is not violated by the planned integration of visual text and related temporal pauses described in Section 10.7 above.

The VWMU principle requires further research to deepen understanding of its potential usage and limitations; this should include an investigation into its application in learning environments in which an assessment or examination of learning is anticipated. Such an investigation might also include consideration of a student's cognitive styles measured by the object-spatial imagery and verbal

questionnaire (OSIVQ) proposed by Blazhenkova & Kozhevnikov (2009), and how this might impact on incorporation of the VWMU principle.

Challenges

Proposals which might contribute to an increased level of visual literacy among the wider population as sought in Australia (Davis, 2008), are outside the scope of this thesis. However, an attempt to increase the visual literacy, or visuacy (Avgerinou & Pettersson, 2011) of teachers and lectures in post-compulsory education is suggested by the findings of this thesis, and such changes might be initiated by changes to the ITT curriculum. Bleed (2005) suggests it is important to embed visual literacy into early stages of teacher education programmes, yet the findings of the Lecturers main study indicated visual aid design and use was not included in ITT for many respondents who trained in the UK, and it remains unclear to what extent this situation prevails in this country. Additional research is now required to establish the degree to which this is the case, and if so, what possibilities exist to lobby for the inclusion of visual aid tuition in future ITT.

The challenges involved in encouraging time and resource-pressured academics and teaching professionals to adopt a practice which may require an allocation of additional resources should not be underestimated, and further research is required to support the validity of such considerations. For some, this may require an adaptation of their use of visual aids toward a more student focussed approach, although adoption of the VWMU principle is not opposed by any of the approaches to teaching identified by Trigwell & Prosser (1996). In Chapter 3, I discussed the notion that media-based visual aids may be employed in support of all approaches to teaching, rather than restricted to teacher-centred methods as suggested by Trigwell & Prosser (1996). This proposal is supported by the findings of Norton et al. (2005); however, in Chapter 3, I suggested this did not preclude visual aids from being information-transmissive in style even if a facilitative approach is adopted by a lecturer. To some extent this notion has been supported by Kosslyn et al. (2012) who found that PowerPoint presentations used in education were not markedly different in terms of cognitive limitations to those used in commercial arenas such as engineering or business. The Lecturers main study added to this finding and recorded that many respondents engaged in ITT and post-graduate education studies also used visual aids which were primarily information-transmissive in so far

as their slides comprised text-based summaries. Yet this finding was often counter to respondents' descriptions of their teaching practice, in which most lecturers indicated that they employed a facilitative approach. This inconsistency was not limited to lecturers; one respondent described how her students attempted to persuade her to create visual aids which contained as much information as possible, rather than the brief text with which she wished to summarise.

Despite the findings of the Lecturers main study that text-based, information-transmissive visual aids often dominated practice, this thesis has found no reason why media-based visual aids should not be employed in support of all approaches to teaching, as proposed by Norton et al. (2005). That they may not have routinely done so to date may be connected to a lack of disseminated knowledge Berk (2011) combined with a deceptive creative simplicity offered by text-based PowerPoint templates.

11.9 Conclusion

This chapter has considered the findings of the four studies undertaken in this thesis in the light of the literature and of existing theories. It has considered the possibility that teachers and lecturers in post-compulsory education may regularly underutilise the mental processing capability of their students by the display of iterative text summaries concurrently with speech. It discussed evidence which suggests a lack of guidance in this area may exist in contemporary ITT, and has recommended further research be undertaken.

The chapter has proposed an approach to the display of text in lectures with a student-centred emphasis and which might be employed with minimal additional resource allocation. The chapter has also proposed a principle of Visual Working Memory Utilisation (VWMU) which might guide the design of visual aids by the germane employment of visual working memory, and which should form part of research undertaken in a lecture environment.

The next chapter summarises the thesis and makes recommendations for future research in the area of visual support for teaching and lecturing.

Chapter 12 Conclusion

12.1 Introduction

This chapter summarises the main themes contained in this thesis. It describes the contributions made to research and discusses the implications for educational practice. The chapter ends by offering suggestions for future research which, it is suggested, should build on the findings of this thesis.

12.2 Main themes

In the literature review I established that little is reported in comparative media research with regard to the content of visual support for learning, beyond description of the media themselves. This led me to employ a dual approach which sought firstly to establish how post-compulsory teachers and lecturers design their visual aids and integrate them into the learning process, and secondly to inquire into how different visual modalities may support learning in a lecture environment.

Concurrent speech and text

It was established that for many teachers and lecturers, text-based slides are employed as an aid to lecture planning and as prompts during a lecture. However, exactly what pedagogical function the presentation of such textual summaries has on the part of a student when presented concurrently with speech remains unclear. Reports in the literature of students' appreciation of text-based displays created in PowerPoint may be linked to the provision of online visual aid sets before lectures, and the value of such slides when printed as notes for future revision. However, once such requirements are removed, the benefit offered by the display of this modality during a lecture becomes unclear. An important finding was that concurrent presentation of speech and text during a lecture may create a split attention effect (Chandler & Sweller, 1991) by the engagement of a single working memory channel to process two sources of language simultaneously (Schnotz, 2005).

Most studies which have investigated the efficacy of PowerPoint in a lecture setting have not recorded differences in design between pre-lecture notes and slides shown during the lecture (see for example, Levasseur & Kanan Sawyer, 2006), which suggests some may routinely comprise the same content. This notion was investigated in the Lecturers main study, and it was found that for many of the

participants, their pre-lecture notes and lecture visual aids comprised the same slides.

This thesis has identified that many researchers appear to have overlooked the notion that the primary influence of visual aids upon learning may be their content, rather than the modality through which they are displayed (Clarke, 1983). Although presentation technology has developed significantly since the 1980s and evolved from OHP to digital projection, to some extent the visual content has remained constant and predominately text-based. This finding offers some enlightenment as to why some 21st century students have described their lectures as boring, and attributed the cause in part to the display of PowerPoint (Mann & Robinson, 2009).

The Modalities exploratory study compared the display of images which were relevant to the lecture topic but which lacked a pedagogical function, to that of text-based slides, and found the former did not provide a significant improvement in recall over text. This suggests the arbitrary selection of relevant images for visual support may have minimal impact upon learning. These findings represent a reduction of the gap identified in the literature with regard to the nature of visual aids employed by teachers and lecturers, and are important because they have redirected the investigation from the display medium itself toward the pedagogical design and function of the content.

Rationales for visual aid use

The Lecturers main study provided insight into the rationales which underpin lecturers' choices for visual learning support. A key finding was that although all participants were employed as professional teachers or lecturers, only one of the 29 trained in the UK had received tuition in the design and display of visual aids during their ITT. This finding is important because it suggests many education professionals may possess a limited degree of 'production literacy' (Messaris, 1994) with regard to visual aid creation. In the literature review this observation was linked to a wider cultural view which holds images as unworthy of inclusion in the education of post-adolescent adults.

Also of importance is the observation that pedagogical knowledge does not appear to have compensated for a lack of visual aid tuition among most teachers and lecturers interviewed in the Lecturers main study. This suggests research may be

warranted into qualified teachers' understanding of established theories which relate to memory and mental processing, and which might inform visual aid practice in the absence of formal training in this area.

Utilisation of visual processing capacity

The carefully planned utilisation of visual working memory was found to be effective when employed in support of the abstract topic chosen for the Modalities main study, and provided empirical support for established memory and processing models within a live teaching environment; in particular, dual coding theory, working memory theory and cognitive load theory. This study has widened the inquiry from the computer-based learning domain in which much contemporary research is situated, to a synchronous teaching environment led by a lecturer. The thesis drew on the research of Kosslyn & Moulton (2009) and others into mental imagery to broaden the concept of a visual aid beyond that which is retinally perceived, to include the stimulation of imagery as an aid to a lecturer's speech, and this modality was found to produce a significant impact upon engagement and affect for the chosen topic.

The thesis synthesises the findings of the literature review and the four studies undertaken into a principle of Visual Working Memory Utilisation (VWMU), which proposes that learning may be optimised by the planned utilisation of visual working memory. Further research is now warranted into visual support for the wider range of topics taught in post-compulsory education, in order to further explore further applications of the VWMU principle. Such investigations should commence the building of an armamentarium of pedagogical content knowledge (Shulman, 1986).

Projected text may impede the visual processing ability of students

This thesis has raised important questions with regard to the provision of text concurrently with speech, which the literature suggests may be experienced by a large proportion of post-compulsory students. When established models of memory were applied to the technique, they were found to be inconclusive. Additionally, I was unable to identify a benefit to learning which could be attributed to the concurrent delivery of speech and slides which comprised 40-60 words, in either the Modalities exploratory study or the Modalities main study, and these findings led to recommendations for the display of non-redundant text described in Chapter 11.

This study has added to the visual aid literature by finding that textual displays of five words or fewer had a positive impact on recall of key phrases. This thesis has thus widened the debate which relates to the display of text, and provided a platform from which to further investigate and refine the use of this modality.

Metaphor

I asked respondents if they ever used imagery over and above everyday use of metaphor, but did not probe this area deeply. Later, when I undertook the Modalities main study, the Guided-Imagery results highlighted how effective a simple simile could be in assisting recall; for example when I likened the concept of staff working together to 'ants', many participants recalled the analogy. This suggests the inclusion of metaphor as a component of the VWMU principle may be justified.

Research methodology

As the thesis developed, a research methodology was employed which combined quantitative and qualitative methods. This approach was considered in the context of a culture in which some strongly held views exist with regard to the primacy of specific research paradigms. Choices in this arena were discussed, and a decision reached that the transferability of findings was unlikely to be adversely affected by the selection of a mixed methods approach.

Two exploratory studies were undertaken which employed a methodology which was primarily quantitative in design, and the limited findings suggested that a mixed method approach in the Modalities main study might provide additional insight. The richness of the data achieved from a combination of quantitative data from a post-lecture test and evaluation results, and a qualitative analysis of focus group data, supported the adoption of a mixed methods approach.

12.3 Limitations

This thesis has commenced an inquiry into the impact of visual modalities upon learning in a lecture environment, however the studies are limited by some elements of the research design; in particular, the topic of instruction in the Modalities main study, the utilisation of a sample of NHS staff as participants, and the use of focus groups for qualitative data collection.

The Modalities main study involved a sample of NHS staff selected from a wide range of professions and roles. Because the participants were on paid duty during the planned interventions, I chose a lecture topic that was unknown to participants as well as being relevant to all professions and the needs of their employing organisation. The subject matter was relatively abstract and contained little intrinsic motivation to learn, and there was no anticipation of assessment for those who attended. In this way I aimed to reduce the number of variables which might impact upon learning such as intrinsic interest and the anticipation of any testing, and thereby highlight the impact of the visual aids. Although this approach allowed me to focus closely on the impact of each visual modality, the choice of a topic which did not form part of an educational syllabus has limited the transferability of the findings because the subject matter is not readily comparable to that taught in post-16 education. Similarly, the lecture had no associated assessment and as such was not aligned with common educational practice. The research design might be improved by placing such an intervention within a formal educational setting, such as an undergraduate programme with an established subject and formal assessment, and using an intervention comprising contrasting visual modalities to support a whole module.

For the Modalities main study, I selected my sample from NHS staff because I required 300-400 participants who had attained variety of levels of educational attainment, and these were readily available to me due to my teaching role. Additionally, I was responsible for delivery of the programme, and this allowed me the opportunity to design alternative visual support for the interventions. My chosen sample provided a variety of participants, which while not randomly selected, were allocated to each intervention by the fact they had self-nominated to the different course dates with no knowledge of any content differences. However, the sample was not representative of post-16 education, and the design could be improved by the selection of participants from an established educational programme which contains a formal assessment, such as a module from an undergraduate programme as suggested above. Such a change would increase transferability for the reader.

In the Modalities main study I chose focus groups as a data collection method largely because of practical restrictions which arose from all participants being present whilst on paid duty, and also because the focus group method provided an

opportunity to gain data from six attendees concurrently within the time available on the study days. However, a richer vein of data may have been obtained by the employment of individual interviews because such a method offers more time for each individual, and allows the interviewer more time to probe relevant issues. Interviews and focus groups are not substitutes for each other however (Kaplowitz & Hoehn, 2001), and the research design could be improved by utilising a combination of focus groups and individual interviews to ensure an optimal richness and breadth of data (Cohen et al., 2000; Lambert & Loiselle, 2008). The engagement of such a design with a complete course module would facilitate data collection at spaced intervals, rather than the close proximity to the event utilised in this study.

The Modalities main study did not include a control group because the study was not conducted in the form of an experiment (although the Trad-PPt modality provided this role to some extent). However, a quasi-experiment which includes a control in which no visual stimulation is experienced at all, might offer additional insight and also increase transferability.

The Lecturers main study provided valuable insight and data, and has raised further questions with regard to the knowledge and practice of teachers and lecturers in the arena of visual aids. In particular the inclusion of 'ideal types' (Maxwell, 1992) in the form of lecturers in education studies provided rich information, although the sample size was not sufficiently large to generalise the results to the wider post-compulsory teaching population in the UK. A larger study is now indicated in order to establish the prevalence of visual 'production literacy' (Messaris, 1994) within this professional group.

For future research into the impact of visual modalities in post-compulsory education, some of the limitations outlined above might be overcome by undertaking planned interventions within an established programme such as an undergraduate module which contains a summative assessment. As well as acquiring data from group discussions, randomly selected participants would be invited to participate in individual interviews at intervals linked to key elements of the intervention. Additionally, the impact of interventions on summative assessment outcomes would increase the transferability of such studies.

12.4 Personal learning

As I progressed through the interviews in the Lecturers main study, I became more at ease in the role of researcher-interviewer, and consistently received frank and open responses in both telephone and face to face formats, despite the fact that the conversation often included an admission on the part of the interviewee that their visual aids were not as purposeful as they would like. I have been reassured by conversations with participants I have met since undertaking the study that the experience resulted in them thinking about their practice, and giving more consideration to their visual aid designs.

On two occasions I offered a comment of my own during an interview, in the form of a conversational response. Although I did so with participants who were also known to me as colleagues, this did not have the effect of encouragement that might be expected during an informal conversation; it was as though I had taken some of their response time and stepped outside my remit, albeit only for a few seconds. This experience led me to realise that our respective roles had effectively been set for the duration of the interview, and there was a protocol to be observed during that period.

Although I have been teaching for many years, and have used various methods of measurement and feedback for teaching techniques in this time, the employment of focus groups in the Modalities main study provided a richness of information with regard to learners' experiences, and an associated insight into my practice that I had not experienced before, and I found it truly enlightening.

12.5 Contributions

This thesis has addressed some concerns raised in the literature with regard to a lack of research into visual learning design (Christie & Collyer, 2005; Craig & Amernic, 2006; Levasseur & Kanan Sawyer, 2006; Ricer et al., 2005), and has provided data which reduces a gap in the visual aid literature that exists between laboratory-based research into the design of computer-based learning, and lecture-based research into media differences in which content is not considered as a variable.

It has made the following contributions to the understanding of teaching and lecturing practice in a post-compulsory educational environment:

- Tuition in the design and use of visual aids has been absent from some ITT curricula in the UK in recent decades. This situation may be linked to cultural influences in which text is regarded more highly than images.
- The projection of text concurrently with a lecturer's speech is not clearly supported by established psychological theories, or by the results of the Modalities main study, and its provision without pauses and planned integration may not utilise working memory optimally.
- Visual working memory may be productively engaged among post-16 learners by 'bottom up' presentation of pedagogically functional visual aids, and by 'top-down' stimulation of students' mental images and models.
- The presentation of large minimalist text which comprises a maximum of 5 words may enhance recall, and avoid creation of a redundancy effect.
- The provision of images which are pedagogically purposeful may improve learner outcomes and increase engagement, although this effect was not found for images which were relevant but merely decorative.
- This thesis proposes the adoption of a principle in which visual working memory utilisation is planned into lessons and lectures, and which may increase learner engagement, affect and outcomes.

12.6 Implications for educational practice

In the 21st century, visual support for post-compulsory learning is frequently created digitally by means of computer software such as PowerPoint and Keynote. Such productions are made available to students via Intranet systems pre and post-lecture (Exley & Dennick, 2009), and via digital projection systems during lectures. Yet this thesis has identified a disjunction between contemporary theories which relate to the visual processing capabilities of the brain, and the visual support for learning provided for students. In particular, it has noted that established models such as working memory theory (Baddeley & Hitch, 1974), cognitive load theory and associated limitations brought about by the redundancy effect (Chandler & Sweller, 1991), and dual coding theory (Paivio, 1979), may not routinely impact upon practice. Importantly, this thesis suggests two commonly used forms of visual aid,

namely textual summaries of a lecturer's speech, and images which are relevant but which lack a defined pedagogical function, are not readily supported by such theories, and the Modalities exploratory study indicated these modalities may not assist learning to the degree that their popularity implies. This disjunction between theory and practice should be addressed in order to encourage thought and optimise capacity for holding new ideas among learners during lectures (Bligh, 2000). For instance, in-service training sessions for lecturers and teachers could include sections which promote teaching methodologies that incorporate the VWMU principle, and ways in which contemporary software might be employed to support this approach.

Much of the research which has inquired into educational media to date has excluded details of content (Clarke, 2001; Levasseur & Kanan Sawyer, 2006), and consequently has been somewhat self-limiting in its conclusions. Despite this, Trigwell and Prosser (1996) linked the use of media with a teacher-centred approach to learning without reference to content, and although Norton et al. (2005) note that use of media is not restricted to lecturers with a teacher-centred approach to learning, the findings of Lecturers' main study suggest that some lecturers with a facilitative approach to teaching may paradoxically employ visual aids which are restricted to iteration of the spoken word, and as such are essentially teacher-centred in design. Consequently it should be noted that the use of media does not, in and of itself, ensure pedagogically effective use of a learner's visual channel, and the Modalities main study identified the content of visual aids to be an important variable in its own right.

In addition to the findings of Yilmazel-Sahin (2009) in the US in which some teacher-educators were found to read aloud from slides, the Lecturers main study found the use of information-transmissive visual aids practices may also exist in ITT and postgraduate educational studies in the UK, with an attendant influence on future teachers and lecturers due to the impact of modelling (Vallance & Towndrow, 2007). A concerted effort should be undertaken to ensure that the term 'media' is not accepted as a sufficient descriptor for investigations into visual support for learning within the ITT curriculum; rather that it is the nature of visual content itself that should receive prominence in research and dissemination of this important element of teaching and learning.

In order to offer optimal conditions for student learning in a lecture environment, (an area identified by some researchers as less than optimal (Apperson et al., 2006; Bartsch & Cobern, 2003)), this thesis suggests the ITT curriculum should be reviewed with a view to inclusion of this pedagogically important aspect of teaching methodology. For example, the Visual Literacy Competency Standards for Higher Education drawn up by the Association of College and Research Libraries in the US (Hattwig et al., 2011) present a useful reference point from which to begin. In particular, visual production literacy (Messaris, 1994) should be focussed upon in order to ensure this skill is offered to trainee teachers as a key component of their teaching skill set. Such additions should also be considered for shorter courses such as LTHE programme, and in-service training in general for teachers and lecturers.

Additionally it is recommended that future research which involves educational media should take visual aid content into account in order to produce empirical as well as theoretical conclusions with which to inform the practice of teachers and lecturers. For example, the impact upon learning outcomes and student appreciation when the VWMU principle is applied to lecture materials independently of pre-lecture and post-lecture notes should be researched.

This thesis has found that the employment of visual media in support of a lecturer's words can aid thinking, and optimise available working memory for learners, as long as such displays are created with a pedagogical purpose. An exponential increase in the availability and display of images on the Internet has taken place in the 21st century (Olivarez-Giles, 2011), however such profligacy does not necessarily correlate to an increase in visual literacy, and in the educational world there should be a move toward pedagogical content knowledge (Shulman, 1986) which follows the VWMU principle in order to utilise this important medium. For example, further research which focusses on the visual element of pedagogical content for individual subjects would provide informed resources for teachers and lecturers and increase their knowledge base.

Inclusion of the VWMU principle in the planning and execution of lectures would encourage attention to be directed toward the discrete functions of visual aids, in their pre and post-lecture utilisation as well as their use during a lecture. This thesis proposes that the VWMU principle should be introduced into ITT in a coherent,

planned way which includes the concept of visual literacy (Debes, 1969), and in particular production literacy (Messaris, 1994), and should include dissemination of redundancy theory (Chandler & Sweller, 1991). For example, lesson and lecture plans created by ITT students could be designed to indicate the nature and purpose of visual content. Such a move toward an informed use of visual media may initiate a displacement of popularist notions of visual support for learning as beneficial only to those classified as 'visual learners' (Sharp et al., 2008) in favour of pedagogically valid visual support for learning.

The findings of the Modalities main study suggest that, although a change in emphasis from lecturer-oriented slides to student-centred visual aids may improve the achievement of some educational outcomes, the allocation of additional resources may be required in order to produce slide sets which meet the disparate requirements of lecture planning, visual aids and student revision notes. Funding and lecturers' time are inevitably limited, however existing but currently underutilised Internet-based resources might be employed; for example '*OurSubject*' (HUDCETT, 2010), the '*Learning Designer*' (Laurillard et al., 2012), and the '*Periodic Table of Visualisation*' (Lengler & Eppler, 2007) might be combined to facilitate visual aid creation, and to reduce demands on teachers and lecturers who might otherwise be disinclined to devote additional time and resources to the task. Additionally, a visual aid 'plugin' might be developed for PowerPoint which offers guidance in visual aid creation, and which, when used in combination with the online planning aids described above, may encourage time-pressed teachers and lecturers to expand their envelope of visual aid design.

12.7 Further research

The amount of text that students are able to read whilst they simultaneously listen to a lecturer's speech remains unclear. This thesis found no evidence to support the practice of displaying textual summaries comprising 40-60 words concurrently with speech without temporal pauses, once a requirement for the provision of revision notes is removed. However, the finding that short summaries of 3-5 words aided recall suggests further research into the student-centred provision of text may offer additional insight. Such a comparison should ideally be undertaken in an environment in which assessment is anticipated in order to optimise transferability.

This thesis touched on the area of descriptive speech and metaphor as a stimulus for visual working memory, and it is possible that the active integration of such techniques into a lecture may produce a measurable impact upon learning outcomes. Research into the effect of tropes in a lecture setting may also broaden the principle of Visual Working Memory Utilisation proposed in Chapter 11.

The area of cognitive styles and learning styles may provide further insight into the domain of visual aids in the future, and might also provide peer-reviewed research to inform lecturers in place of popularist theories. Such research will also doubtless continue to be informed by fMRI and ERP based studies, and thus facilitate the development of visual aids which support human cognitive architecture.

This thesis has created a platform from which to launch further inquiries into the design and display of visual aids in post-compulsory teaching, and such investigations should be of interest to teachers and lecturers engaged in the teaching of a variety of topics. Such research should also be of benefit to large numbers of learners, whether they employ a surface or deep approach to learning, and thereby increase the proportion of students who describe the visual support they receive in lectures as helpful.

96,207 words

References

- Abbasi, K. (1999). Guidelines for evaluating papers on educational interventions. *British Medical Journal*, 318(7193), 1265-1267.
- Adams, C. (2006). PowerPoint, habits of mind, and classroom culture. *Journal of Curriculum Studies*, 38(4), 389-411.
- Adesope, O. O., & Nesbit, J. C. (2012). Verbal redundancy in multimedia learning environments: A meta-analysis. *Journal of Educational Psychology*, 104(1), 250-263.
- Ainsworth, S. (2006). DeFT: A conceptual framework for considering learning with multiple representations. *Learning and Instruction*, 16(3), 183-198.
- Albany-Ward, K. (2010). The unrecognised SEN. *Attain*, 20-23.
- Alise, M. A., & Teddlie, C. (2010). A continuation of the paradigm wars? Prevalence rates of methodological approaches across the social/behavioral sciences. *Journal of Mixed Methods Research*, 4, 103-126.
- Alley, M. (2013). *The craft of scientific presentations* (2nd ed.). New York: Springer.
- Alliger, G. M., Tannenbaum, S. I., Bennett, W. B., Traver, H., & Shotland, A. (1997). A meta-analysis of the relations among training criteria. *Personnel Psychology*, 50, 341-358.
- Ally, B. A., Waring, J. D., Beth, E. H., McKeever, J., Milberg, W. P., & Budson, A. E. (2008). Ageing memory for pictures: Using high-density event-related potentials to understand the effect of ageing on the picture superiority effect. *Neuropsychologia*, 46(2), 679-689.
- Amedi, A., Malach, R., & Pascual-Leone, A. (2005). Negative BOLD differentiates visual imagery and perception. *Neuron*, 48, 859-872.
- Amorim, M. A., Isablu, B., & Jarraya, M. (2006). Embodied spatial transformations: "Body Analogy" for the mental rotation of objects. *Journal of Experimental Psychology: General*, 135(3), 327-347.
- Anderson, G. (1998). *Fundamentals of educational research*. London: Falmer Press.
- Anderson, R. C., & Kulhavy, R. W. (1972). Imagery and prose learning. *Journal of Educational Psychology*, 63, 242-243.
- Antion, T. (1999). *Wake 'em up: How to use humour and other professional techniques to create alarmingly good business presentations*. Landover Hills, MD.
- Apperson, J. M., Laws, E. L., & Scepansky, J. A. (2006). The impact of presentation graphics on students' experience in the classroom. *Computers & Education*, 47, 116-126.
- Armbruster, B. (2008). Notetaking from lectures. In R. F. Flipppo & D. C. Caverly (Eds.), *Handbook of college reading and study strategy research* (2nd ed., pp. 220-248). New York: Routledge.
- Armstrong, I. (2007). 'The Lady of Shalott': Optical elegy. In J. Lyons & J. Plunkett (Eds.), *Multimedia histories: From the magic lantern to the internet*. Exeter: University of Exeter Press.
- Ary, D. C., Jacobs, L., Razavieh, A., & Sorenson, C. (2006). *Introduction to research in education* (7th ed.). Belmont: Thomson Wadsworth.
- Aston, U. o. (2011). Learning Styles. Retrieved 12 October 2011, from <http://www1.aston.ac.uk/current-students/academic-support/ldc/get-ahead/learning/learning-styles/>
- Atkinson, C. (2004). Five experts dispute Edward Tufte on PowerPoint. Retrieved 13 July 2006, from http://www.sociablemedia.com/articles_dispute.htm
- Atkinson, C. (2005a). *Beyond bullet points: Using Microsoft PowerPoint to create presentations that inform, motivate, and inspire*. Redmond, Washington: Microsoft Press.
- Atkinson, C. (2005b). The cognitive load of PowerPoint: Q&A with Richard E Mayer. Retrieved 19 April 2009, from http://www.sociablemedia.com/articles_mayer.htm
- Atkinson, C., & Mayer, R. (2004). Five ways to reduce PowerPoint overload. Available from http://www.sociablemedia.com/PDF/atkinson_mayer_powerpoint_4_23_04.pdf
- Austin, J. L., Lee, M., & Carr, J. C. (2004). The effects of guided notes on undergraduate students' recording of lecture content. *Journal of Instructional Psychology*, 31, 314-320.
- Austin, J. L., Lee, M. G., Thibeault, M. D., Carr, J. E., & Bailey, J. S. (2002). Effects of guided notes on university students' responding and recall of information. *Journal of Behavioural Education*, 11(4), 243-254.
- Ausubel, D. P. (1960). The use of advance organisers in the learning and retention of meaningful verbal material. *Journal of Educational Psychology*, 51(5), 267-272.
- Ausubel, D. P., & Youssef, M. (1965). The effect of spaced repetition on meaningful retention. *The Journal of General Psychology* 73(1), 147-150.

- Avgerinou, M. D., & Pettersson, R. (2011). Toward a cohesive theory of visual literacy. *Journal of Visual Literacy*, 30(2), 1-19.
- Awh, E., Jonides, J., Smith, E., Schumacher, E. E., Koeppel, R., & Katz, S. (1996). Dissociation of storage and rehearsal in verbal working memory: Evidence from positron emission tomography. *Psychological Science*, 7(1), 25-31.
- Babbitts, J. (2004). Stereographs and the construction of a visual culture in the United States. In L. Rabinovitz & A. Geil (Eds.), *Memory bytes: History, technology, and digital culture*. London: Duke University Press.
- Baddeley, A. D. (2000). The episodic buffer: A new component of working memory? *Trends in Cognitive Science*, 4(11), 417-423.
- Baddeley, A. D. (2003a). Working memory and language: An overview. *Journal of Communication Disorders*, 36(3 May-June), 189-208.
- Baddeley, A. D. (2003b). Working memory: Looking back and looking forward. *Nature Reviews Neuroscience*, 4(10), 829-839.
- Baddeley, A. D. (2007). *Working memory, thought, and action*. Oxford: Oxford University Press.
- Baddeley, A. D., & Andrade, J. (2000). Working memory and the vividness of imagery. *Journal of Experimental Psychology: General*, 129(1), 126-145.
- Baddeley, A. D., & Hitch, G. J. (1974). Working memory. In G. Bower (Ed.), *Recent advances in learning and motivation* (Vol. 8, pp. 47-90). New York: Academic Press.
- Bahn, P. G., & Vertut, J. (2001). *Journey through the ice age*. Berkeley, LA: University of California Press.
- Bandler, R., & Grindler, J. (1979). *Frogs into princes: Neuro linguistic programming*. Moab, UT: Real People Press.
- Barbour, R. (2007). *Doing focus groups*. London: Sage.
- Barsalou, L. W., & Wiemer-Hastings, K. (2005). Situating abstract concepts. In D. Pecher & R. Zwaan (Eds.), *Grounding cognition: The role of perception and action in memory, language, and thought* (pp. 129-163). New York: Cambridge University Press.
- Bartsch, R. A., & Cobern, K. M. (2003). Effectiveness of PowerPoint presentations in lectures. *Computers & Education*, 41(1), 77-86.
- Baruch, Y., & Holtom, B. C. (2008). Survey response rate levels and trends in organisational research. *Human Relations*, 61(8), 1139-1160.
- Befus, R. (2005). The 1981 Wharton Study. Retrieved 10 October 2010, 2009, from <http://www.visualbeing.com/2005/07/14/%E2%80%9Cthe-1981-wharton-study%E2%80%9D/>
- Belger, A., Puce, A., Krystal, J. H., Gore, J. C., Goldman-Rakic, P., & McCarthy, G. (1998). Dissociation of mnemonic and perceptual processes during spatial and working memory using fMRI. *Human Brain Mapping*, 6(1), 14-32.
- Bell, J. (2005). *Doing your research project* (4th ed.). Maidenhead: Open University Press.
- BERA (2011). *Ethical guidelines for educational research*. London: British Educational Research Association.
- Bergen, B. K. (2012). *Louder than words*. New York: Basic Books.
- Berk, R. A. (2011). Research on PowerPoint: From basic features to multimedia. *International Journal of Technology in Teaching and Learning*, 7(1), 24-35.
- Betts, G. H. (1909). *The distribution and functions of mental imagery*. New York: Teachers College, Columbia University.
- Beyerstein, B. L. (2004). Do we really use only 10 percent of our brains? *Scientific American*. Retrieved from <http://www.scientificamerican.com/article.cfm?id=do-we-really-use-only-10>
- Biggs, J., & Tang, C. (2011). *Teaching for quality learning at university*. Maidenhead: Open University Press.
- Birmingham, U. o. (2011). Visual learning. Retrieved 12 October 2011, from <http://www.as.bham.ac.uk/studentlife/disability/learningsupport/effective/visual.shtml>
- Blair, I. V., Ma, J. E., & Lenton, A. P. (2001). Imagining stereotypes away: The moderation of implicit stereotypes through mental imagery. *Journal of Personality and Social Psychology*, 81, 828-841.
- Bland, D. C. (2009). *Visuacy, imagination, and engagement*. Paper presented at the 1st International Visual Methods Conference, Leeds.
- Blazhenkova, O., & Kozhevnikov, M. (2009). The new object-spatial-verbal cognitive style model: Theory and measurement. *Applied Cognitive Psychology*, 23, 638-663.
- Bleed, R. (2005). *Visual literacy in higher education*: Maricopa Community Colleges.
- Bligh, D. A. (2000). *What's the use of lectures?* San Francisco: Jossey-Bass.

- Bloom, B. S. (1953). Thought-processes in lectures and discussions. *The Journal of General Education*, 7(3), 160-169.
- Bloor, M., Frankland, J., Thomas, M., & Robson, K. (2001). *Focus groups in social research*. London: Sage.
- Bluestone, G. (1957). *Novels into film: The metamorphosis of fiction into cinema*. Maryland: Johns Hopkins Press.
- Bollington, M. (2012). *Participation rates in higher education: Academic years 2006/7 - 2011/12*. London: Department for Business, Innovation & Skills.
- Borst, G., Ganis, G., Thompson, W. L., & Kosslyn, S. M. (2012). Representations in mental imagery and working memory: Evidence from different types of visual masks. *Memory and Cognition*, 40(2), 204-217.
- Bourque, L. (2002). *How to conduct self-administered and mail surveys* (2nd ed.). Thousand Oaks, CA: Sage.
- Bowman, L. (1999). *High impact presentations*. London: Bene Factum.
- Boyatzis, R. E. (1998). *Transforming qualitative analysis: Thematic analysis and code development*. Thousand Oaks, CA: Sage.
- Braden, R. A. (1994). Visual verbal relationships. In D. M. Moore & F. M. Dwyer (Eds.), *Visual literacy*. Englewood Cliffs, NJ: Educational Technology Publications.
- Brand, S., Reimer, T., & Opwis, K. (2007). How do we learn in a negative mood? Effects of a negative mood on transfer and learning. *Learning and Instruction*, 17(1), 1-16.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101.
- Bridge, H., Harrold, S., Holmes, E. A., Stokes, M., & Kennard, C. (2012). Vivid visual mental imagery in the absence of the primary visual cortex. *Journal of Neurology*, 259, 1062-1070.
- Brown, A. S., & Marsh, E. J. (2008). Evoking false beliefs about autobiographical experience. *Psychonomic Bulletin & Review*, 15(1), 186-190.
- Brunken, R., Plass, J. L., & Moreno, R. (2010). Current issues and open questions in cognitive load research. In J. L. Plass, R. Moreno & R. Brunken (Eds.), *Cognitive load theory*. New York: Cambridge University Press.
- Bryman, A. (2008). *Social research methods* (3rd ed.). Oxford: Oxford University Press.
- Buccino, G., Riggio, L., Melli, G., Binkofski, F., Gallese, V., & Rizzolatti, G. (2005). Listening to action-related sentences modulates the activity of the motor system: A combined TMS and behavioural study. *Cognitive Brain Research*, 24, 355-363.
- Bull, P. (1990). What does gesture add to the spoken word? In H. Barlow, C. Blakemore & M. Weston-Smith (Eds.), *Images and understanding* (pp. 108-121). Cambridge: Cambridge University Press.
- Bumstead, J. F. (1841). *The blackboard in the primary school*. Boston, USA: Perkins & Marvin.
- Burke, L. A., Ahmadi, M., & James, K. (2009). Effectiveness of PowerPoint-based lectures across different business disciplines: An investigation and implications. *Journal of Education for Business*, 84(4), 246-251.
- Buswell, G. (1935). *How people look at pictures*. Chicago: University of Chicago Press.
- Byrne, E. (1993). *Women and science: The snark syndrome*. London: Falmer Press.
- Cahill, L., Haier, R. J., Fallon, J., Alkirei, M. T., Tangii, C., Keatorii, D., et al. (1996). *Amygdala activity at encoding correlated with long-term, free recall of emotional information*. Paper presented at the Proceedings of the National Academy of Sciences of the United States of America, USA.
- Callicott, J. H., Mattay, V. S., Bertolino, A., Finn, K., Coppola, R., Frank, J. A., et al. (1999). Physiological characteristics of capacity constraints in working memory as revealed by functional MRI. *Cerebral Cortex*, 9, 20-26.
- Carpenter, S. K., Wilford, M. M., Kornell, N., & Mullaney, K. M. (2013). Appearances can be deceiving: Instructor fluency increases perceptions of learning without increasing actual learning. *Psychonomic Bulletin & Review*.
- Carroll, J. B., & Morrell, P. D. (2006). A comparison of teacher education faculty and preservice teacher technology competence. *Journal of Computing in Teacher Education*, 23(1), 5-9.
- Chabris, C. F., & Kosslyn, S. M. (2005). Representational correspondence as a basic principle of diagram design. In S. O. Tergan & T. Keller (Eds.), *Knowledge and information visualization* (Vol. 3426, pp. 185-186). Berlin: Springer.
- Chamorrow-Premuzic, T., Furnham, A., Christopher, A. N., Garwood, J., & Martin, G. N. (2008). Birds of a feather: Students' preferences for lecturers' personalities as predicted by their own personality and learning approaches. *Personality and Individual Differences*, 44(4), 965-976.

- Chan, D. W. (2012). Intellectual styles of exceptional learners. In L. Zhang, R. J. Sternberg & S. Rayner (Eds.), *Handbook of intellectual styles*. New York: Springer.
- Chandler, P., & Sweller, J. (1991). Cognitive load theory and the format of instruction. *Cognition and Instruction*, 8, 293-332.
- Chiddick, D., Laurillard, D., Quigley, G., & Wolf, D. (1997). *The National Committee of Inquiry into Higher Education, Appendix 2*. London: Secretaries of State for Education and Employment.
- Christie, B., & Collyer, J. (2005). Audiences' judgements of speakers who use multimedia as a presentation aid: A contribution to training and assessment. *British Journal of Educational Technology*, 36(3), 477-499.
- City&Guilds. (2007). *Level 5 diploma in teaching in the lifelong learning sector (7305) qualification handbook*. London: City & Guilds.
- Clapp, W., Rubens, M. T., & Gazzaley, A. (2010). Mechanisms of working memory disruption by external interference. *Cerebral Cortex*, 20(4), 859-872.
- Clark, R. C., Nguyen, F., & Sweller, J. (2006). *Efficiency in learning: Evidence-based guidelines to manage cognitive load*. San Francisco: Pfeiffer.
- Clark, R. E., & Clark, V. P. (2010). From neo-behaviourism to neuroscience: Perspectives on the origins and future contributions of cognitive load research. In J. L. Plass, R. Moreno & R. Brunken (Eds.), *Cognitive load theory* (pp. 203-228). New York: Cambridge University Press.
- Clark, R. E., & Feldon, D. F. (2005). Five common but questionable principles of multimedia learning. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning*. New York: Cambridge University Press.
- Clarke, J. (2008). PowerPoint and pedagogy: Maintaining student interest in university lectures. *College Teaching*, 56(1), 39-45.
- Clarke, R. (2012). Media are "Mere Vehicles": The opening argument. In R. Clarke (Ed.), *Learning from media: Arguments, analysis, and evidence* (2nd ed., pp. 1-12). Charlotte, NC: Information Age Publishing.
- Clarke, R. (Ed.). (2001). *Learning from media: Arguments, analysis, and evidence*. Charlotte, NC: Information Age Publishing.
- Clarke, R. C., & Lyons, C. (2004). *Graphics for learning*. San Francisco: John Wiley & Sons.
- Clarke, R. E. (1983). Reconsidering research on learning from media. *Review of Educational Research*, 53, 445-459.
- Clatworthy, S., Simon, K., & Tiedeman, M. E. (1999). Child drawing: Hospital-an instrument designed to measure the emotional status of hospitalized school-aged children. *Journal of Pediatric Nursing*, 14(1), 2-9.
- Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004). *Should we be using learning styles? What research has to say in practice*. London: Learning & Skills Research Centre.
- Cohen, J. R. (1980). *Charles Dickens and his original illustrators*. Ohio: Ohio State University Press.
- Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education* (4th ed.). London: Routledge Falmer.
- Cohn, N. (2012). Explaining 'I can't draw': Parallels between the structure and development of language and drawing. *Human Development*, 55, 167-192.
- Craig, R. J., & Amernic, J. H. (2006). PowerPoint presentation technology and the dynamics of teaching. *Innovative Higher Education*, 31(3), 147-160.
- Craig, S. D., Gholson, B., & Driscoll, D. M. (2002). Animated pedagogical agents in multimedia educational environments: Effects of agent properties, picture features, and redundancy. *Journal of Educational Psychology*, 94(2), 428-434.
- Crary, J. (2008). Nineteenth-century visual incapacities. In J. Elkins (Ed.), *Visual literacy*. Taylor & Francis: New York.
- Creed, T. (2001). PowerPoint, no! Cyberspace, yes. Retrieved 4 December, 2009, from <http://www.ntlf.com/html/sf/cyberspace.htm>
- Creswell, J. W., & Plano Clark, V. L. (2007). *Designing and conducting mixed methods research*. London: Sage.
- Cruikshank (2006). Martin Scorsese: Teaching visual literacy. *Edutopia*.
- Curran, T., & Doyle, J. (2011). Picture superiority doubly dissociates the ERP correlates of recollection and familiarity. *Journal of Cognitive Neuroscience*, 23(5), 1247-1262.
- Czaja, R., & Blair, J. (2005). *Designing surveys: A guide to decisions and procedures* (2nd ed.). Thousand Oaks, CA: Sage.
- Dale, E. (1969). *Audio-visual methods in teaching*. New York: Dryden.
- Dallet, K., & Wilcox, S. (1968). Remembering pictures vs. remembering descriptions. *Psychonomic Science*, 11, 139-140.

- Dalton, J. (1798). *Extraordinary facts relating to the vision of colours: With observations*. London: Cadell and Davies.
- Daly, J. (2004). Life on the screen: Visual literacy in education. *Edutopia*(1).
- Damasio, A. R. (1994). Descartes' error and the future of human life. *Scientific American*, 271(4), 144.
- Damasio, A. R. (2006). *Descartes' error*. London: Vintage.
- Daniels, L., Kane, J. C., Rosario, B. P., Creahan, T. A., Liard-Muriente, C. F., & Mallia, M. E. (2008). The impact of PowerPoint on student performance and course evaluations in economics courses: An experiment at six institutions. Retrieved 20 June 2011, from Social Science Research Network: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1090662
- Darling, S., Della Sala, S., & Logie, R. H. (2007). Behavioural evidence for separating components within visuo-spatial working memory. *Cognitive Processing*, 8, 175-181.
- Davis, D. (2008). *First we see: The national review of visual education*: Australian Government, Department of Education, Employment and Workplace Relations.
- De Beni, R., & Moe, A. (2003). Presentation modality effects in studying passages. Are mental images always effective? *Applied Cognitive Psychology*, 17, 309-324.
- de Jong, T. (2010). Cognitive load theory, educational research, and instructional design: Some food for thought. *Instructional Science*, 38, 105-134.
- Dean, G. M., Dewhurst, S. A., & Whittaker, A. (2008). Dynamic visual noise interferes with storage in visual working memory. *Experimental Psychology*, 55(4), 283-289.
- Debes, J. (1969). The loom of visual literacy. *Audiovisual Instruction*, 14(8), 25-27.
- Decety, J., Jeannerod, M., & Prablanc, C. (1989). The timing of mentally represented actions. *Behavioural Brain research*, 34, 35-42.
- Dekeyser, H. (2001). Student preference for verbal, graphic or symbolic information in an independent learning environment for an applied statistics course. In J. F. Rouet, J. Levonen & A. Biarreau (Eds.), *Multimedia learning, cognitive and instructional issues*. Amsterdam: Pergamon.
- DeNeve, K., & Heppner, M. J. (1997). Role play simulations: The assessment of an active learning technique and comparisons with traditional lectures. *Innovative Higher Education*, 21(3), 231-346.
- Denis, M. (1982). Imaging while reading text: A study of individual differences. *Memory & Cognition*, 10, 540-545.
- Denzin, N. K., & Lincoln, Y. S. (1994). *Handbook of qualitative research*. London: Sage.
- Dewey, J. (1913). *Interest and effort in education*. Boston: Houghton Mifflin.
- Di Vesta, F. I., Ingersoll, G., & Sunshine, P. (1971). A factor analysis of imagery tests. *Journal of verbal learning and verbal behaviour*, 10, 471-479.
- Diao, Y., & Sweller, J. (2007). Redundancy in foreign language reading comprehension instruction: Concurrent written and spoken presentations. *Learning and Instruction*, 17, 78-88.
- Dimopoulos, K., Koulaidis, V., & Sklaveniti, S. (2003). Towards an analysis of visual images in school science textbooks and press articles about science and technology. *Research in Science Education*, 33, 189-216.
- Drever, E. (1995). *Using semi-structured interviews in small-scale research: A teacher's guide*. Glasgow: Scottish Council for Research in Education.
- Driessnack, M. (2005). A closer look at PowerPoint. *Journal of Nursing Education*, 44(8), 347.
- Driskell, J. E., Copper, C., & Moran, A. (1994). Does mental practice enhance performance? *Journal of Applied Psychology*, 79, 481-492.
- Duarte, N. (2010). *Resonate*. Hoboken: John Wiley & Sons, NJ.
- Dunbar, R. (2004). *Grooming, gossip and the evolution of language*. London: Faber and Faber.
- Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest*, 14(1), 4-58.
- Dunn, R., & Dunn, K. (1993). *Teaching secondary students through their individual learning styles*. Needham Heights, MA: Allyn and Bacon.
- Durso, F. T., & Johnson, M. K. (1980). The effects of orienting tasks on recognition, recall, and modality confusion of pictures and words. *Journal of Verbal Learning and Verbal Behaviour*, 19, 416-429.
- Dwyer, F. M. (1973). The relative effectiveness of two methods of presenting visualised instruction. *Journal of Psychology*, 85(2), 297-300.
- Dwyer, F. M. (1978). *Strategies for improving visual learning*. Philadelphia: Learning Services.
- Dwyer, F. M. (1984). Effects of mode of instruction, testing, order of testing, and cued recall on student achievement. *Journal of Experimental Education*, 52(2), 86-94.
- Ehrenborg, J., & Mattock, J. (2001). *Powerful presentations*. London: Kogan Page.

- Eilan, B. (2012). *Teaching, learning, and visual literacy: The dual role of visual representation* New York: Cambridge University Press.
- Eilan, N. (2005). Joint attention, communication, and mind. In N. Eilan, C. Hoerl, T. McCormack & J. Roessler (Eds.), *Joint attention: Communication and other minds*. Oxford: Oxford University Press.
- Einstein, A. (1916). *Relativity: The special and general theory* (R. Lawson, Trans.). New York: Henry Holt & Co.
- Elkins, J. (2008). Preface. In J. Elkins (Ed.), *Visual literacy*. New York: Routledge.
- Elliott, K. (2003). *Rethinking the novel/film debate*. Cambridge: Cambridge University Press.
- Ellis, H., Thomas, R., & Rodriguez, I. (1984). Emotional mood states and memory: Elaborative encoding, semantic processing, and cognitive effort. *Journal of Experimental Psychology, Learning, Memory, and Cognition*, 10(3), 470-482.
- Emerson, R. W. (1849). *Nature*. Boston: James Munroe.
- Eppler, M. J., & Burkhard, R. A. (2006). Knowledge visualization: Towards a new discipline and its fields of application. In D. G. Schwartz (Ed.), *Encyclopaedia of knowledge management* (pp. 551-560). Hershey, PA: Information Science Reference.
- Evans, C., & Cools, E. (2009). Editorial: The use and understanding of style differences to enhance learning. *Reflecting Education*, 5(2), 1-18.
- Evans, C., & Cools, E. (2011). Applying styles research to educational practice. *Learning and Individual Differences*, 21, 249-254.
- Evans, C., Richardson, J. T. E., & Waring, M. (2013). Field independence: Reviewing the evidence. *British Journal of Educational Psychology*, 83, 210-224.
- Evans, C., & Vermunt, J. D. (2013). Styles, approaches, and patterns in student learning. *British Journal of Educational Psychology*, 83, 185-195.
- Evans, C., & Waring, M. (2006). Towards inclusive teacher education: Sensitising individuals to how they learn. *Educational Psychology*, 26(4), 499-518.
- Evans, C., & Waring, M. (2008). Trainee teachers' cognitive styles and notions of differentiation. *Education + Training*, 50(2), 140-154.
- Evans, C., & Waring, M. (2012). Applications of styles in educational instruction and assessment. In L. Zhang, R. J. Sternberg & S. Rayner (Eds.), *Handbook of intellectual styles* (pp. 295-327). New York: Springer.
- Evans, J. (2012). *Post-16 education & skills: Learner participation, outcomes and level of highest qualification held*. London: DBIS.
- Evans, M. A., Watson, C., & Willows, D. M. (1987). A naturalistic inquiry into illustrations in instructional textbooks. In H. A. Houghton & D. M. Willows (Eds.), *The psychology of illustration*. New York: Springer-Verlag.
- Exley, K., & Dennick, R. (2009). *Giving a lecture: From presenting to teaching*. Abingdon: Routledge.
- Exley, S., Hughes, S. T., Lambert-Heggs, W., & Webster, S. (2011). *PGCE/Cert Ed module handbook*. Plymouth: University of Plymouth.
- Eysenck, M. W., & Keane, M. T. (2000). *Cognitive psychology: A student's handbook* (4th ed.). Hove: Psychology Press.
- Eysenck, M. W., & Keane, M. T. (2005). *Cognitive psychology, A student's handbook* (5th ed.). Hove: Psychology Press.
- Eysenck, M. W., & Keane, M. T. (2010). *Cognitive psychology: A students' handbook* (6th ed.). Hove: Psychology Press.
- Farah, M. J., Peronnet, F., Gonon, M., & Giard, M. (1988). Electrophysiological evidence for a shared representational medium for visual images and visual percepts. *Journal of Experimental Psychology: General*, 117(3), 248-257.
- Felder, R. M. (2002). Learning and teaching styles in engineering education: Author's preface 2002. *Engineering Education*, 78(7).
- Felder, R. M., & Henriques, E. R. (1995). Learning and teaching styles in foreign and second language education. *Foreign Language Annals*, 28(1), 21-31.
- Fendler, L. (2012). The magic of psychology in teacher education. *Journal of Philosophy of Education*, 46(3), 332-351.
- Fern, E. F. (2001). *Advanced focus group research*. Thousand Oaks, CA: Sage.
- Finke, A. G. (2003). *How to ask survey questions*. Thousand Oaks, CA: Sage.
- Finke, R. A., Johnson, M. K., & Shyi, G. C. (1988). Memory confusions for real and imagined completions of symmetrical visual patterns. *Memory & Cognition*, 16(2), 133-137.
- Fleming, M. (1962). Pictorial communication: An essay on its plight. *Audio Visual Communication Review*, 10(4), 223-237.

- Fleming, N. D. (2011). The VARK Categories. Retrieved 12 October, 2011, from www.vark-learn.com/english/page.asp?p=categories
- Fleming, N. D., & Mills, C. (1992). Not another inventory, rather a catalyst for reflection. *To Improve the Academy*, 11, 137-155.
- Flick, U. (2007). *Managing quality in qualitative research*. London: Sage.
- Forceville, C. (2008). Pictorial and multimodal metaphor in commercials. In E. McQuarrie & B. Phillips (Eds.), *Go figure! New directions in advertising rhetoric*. New York: M.E. Sharpe.
- Foreman, M. N. (Writer) (2011). Illustrated wonderlands, *The Beauty of Books*: BBC 4.
- Fourkas, A. D., Avenanti, A., Urgesi, C., & Aglioti, S. M. (2006). Corticospinal facilitation during first and third person imagery. *Experimental Brain Research*, 168, 143-151.
- Frey, B. A., & Birnbaum, D. J. (2002). Learners' perceptions on the value of PowerPoint in lectures. *ERIC Document Reproduction Service: ED 467192*.
- Gage, N. L. (1989). The paradigm wars and their aftermath. *Educational Researcher* 18(7), 4-10.
- Galton, F. (1880). Statistics of mental imagery. *Mind*, 5, 301-308.
- Ganis, G., Thompson, W. L., & Kosslyn, S. M. (2004). Brain areas underlying visual mental imagery and visual perception: An fMRI study. *Cognitive Brain Research*, 20, 226-241.
- Ganis, G., Thompson, W. L., & Kosslyn, S. M. (2009). Visual mental imagery: More than "seeing with the mind's eye". In J. Brockmole (Ed.), *The visual world in memory*. Hove: Psychology Press.
- Garber, A. R. (2001). Death by PowerPoint. Retrieved 12 April, 2009, from <http://www.smallbusinesscomputing.com/biztools/article.php/684871>
- Garber, R. I. (2010). Joyful public speaking. Retrieved 10 August, 2010, from <http://joyfulpublicspeaking.blogspot.co.uk/2010/03/why-less-is-more-or-even-less.html>
- Gardner, H. (1983). *Frames of Mind*. London: Fontana.
- Gardner, H. (1999). *Intelligence reframed: Multiple intelligences for the 21st century*. New York: Basic Books.
- Garnett, S. (2005). *Using brainpower in the classroom: 5 steps to accelerate learning*. Abingdon: Routledge.
- Garry, M., & Wade, K. A. (2005). Actually, a picture is worth less than 45 words: Narratives produce more false memories than photographs do. *Psychonomic Bulletin & Review*, 12 (2), 359-366.
- Gaskins, R. (2007). PowerPoint at 20: Back to basics. *Communications of the ACM*, 50(12), 15-17.
- Gayford, M. (2011). *A bigger message: Conversations with David Hockney*. London: Thames & Hudson.
- Gazzaniga, M. S., Ivry, R. B., & Mangun, G. R. (2009). *Cognitive neuroscience: The biology of the mind* (3rd ed.). New York: Norton.
- Geake, J. G. (2005). Educational neuroscience and neuroscientific education: In search of a mutual middle way. *Research Intelligence*, 92, 10-13.
- Geertz, C. (1973). Thick description: Toward an interpretive theory of culture. In C. Geertz (Ed.), *The interpretation of cultures* (pp. 3-30). New York: Basic Books.
- Gerrig, R. J. (1998). *Experiencing narrative worlds: On the psychological activities of reading*. Colorado: Westview Press.
- Gibbs, G. (2013, 21 November). The chalk and talk conundrum. *Times Higher Education*, 2128, 24.
- Gibrey, E. (2013). Support suffers as 'unseen army' is cut down. *Times Higher Education*.
- Gillham, B. (2000). *Developing a questionnaire*. London: Continuum.
- Goldsmith, E. (1987). The analysis of illustration in theory and practice. In H. Houghton & D. A. Willows (Eds.), *The psychology of illustration: Instructional issues* (Vol. 2). New York: Springer Verlag.
- Gombrich, E. H. (1978). *Meditations on a hobby horse*. Frome: Butler & Tanner.
- Gomm, R., Hammersley, M., & Foster, P. (2000). Case study and generalisation. In R. Gomm, M. Hammersley & P. Foster (Eds.), *Case study method*. London: Sage.
- Gosline, A. (2005). Why your brain has a 'Jennifer Aniston cell'. *New Scientist*.
- Gow, L., & Kember, D. (1993). Conceptions of teaching and their relationship to student learning. *British Journal of Educational Psychology*, 63, 20-33.
- Grabe, M. (2005). Voluntary use of online lecture notes: Correlates of note use as an alternative to class attendance. *Computers & Education*(44), 409-421.
- Green, D. (2006). *Using digital images in teaching and learning*. Connecticut: National Institute for Technology in Liberal Education, and Wesleyan University.
- Green, M. C., & Brock, T. C. (2002). In the mind's eye: Transportation-imagery model of narrative persuasion. In M. C. Green, J. J. Strange & T. C. Brock (Eds.), *Narrative impact: Social and cognitive foundations*. New Jersey: Laurence Erlbaum.
- Green, R. (1994). The illustrated lecture. *Quarterly Review of Film and Video*, 15(2), 1-23.

- Greene, J. C. (2008). Is mixed methods social inquiry a distinctive methodology? *Journal of Mixed Methods Research*, 2(1), 7-22.
- Griffin, R. (1994). Use of visuals: Business and industry. In D. M. Moore & F. M. Dwyer (Eds.), *Visual literacy: A spectrum of visual learning*. Englewood Cliffs, N.J.: Educational Technology Publications.
- Guadagno, R. E., Muscanell, N. L., Sundie, J. M., Hardison, T. A., & Cialdini, R. B. (2011). *The persuasive power of computer-based multi media presentations*. Paper presented at the annual meeting for persuasion. Persuasive technology and design: Enhancing sustainability and health. Columbus, OH.
- Guba, E. G., & Lincoln, Y. S. (2005). Paradigmatic controversies, contradictions, and emerging influences. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research*. Thousand Oaks, CA: Sage.
- Guggenheim, D. (Writer) (2006). *An inconvenient truth: A global warning*. USA: Paramount.
- Harkin, J. (2005). Fragments stored against my ruin: The place of educational theory in the professional development of teachers in further education. *Journal of Vocational Education and Training*, 57(2), 165-179.
- Harp, S. F., & Mayer, R. E. (1998). How seductive details do their damage: A theory of cognitive interest in science learning. *Journal of Educational Psychology*, 90(3), 414-434.
- Harthan, J. P. (1981). *The history of the illustrated book: The western tradition*. London: Thames and Hudson.
- Harvey, M. (Producer). (2010, 1 January 2011) Royal Society strategies for engaging policy-makers and publics. Podcast retrieved from <http://www.google.co.uk/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&ved=0CDIQFiAA&url=http%3A%2F%2Fwww.acss.org.uk%2Fdocs%2FMH%2520KT%2520present.ppt&ei=XgueUuy9FM2rhAfA-IGACA&usq=AFQjCNGx7wSo-ksnUN9FQltK0cnNNGCP1w&bvm=bv.57155469,d.bGQ>.
- Hattwig, D., Burgess, J., Bussert, K., & Medaille, A. (2011). *ACRL visual literacy competency standards for higher education*: Association of College and Research Libraries, USA.
- Headd, P. W. (1957). Preparing pre-service teachers for audio-visual education. *Journal of Teacher Education*, 8(4), 417-419.
- Heal, J. (2005). Joint attention and understanding the mind. In N. Eilan, C. Hoerl, T. McCormack & J. Roessler (Eds.), *Joint attention: Communication and other minds*. Oxford: Oxford University Press.
- Heinich, R., Molenda, M., Russell, J. D., & Smaldino, S. (2002). *Instructional media and technologies for learning*. Upper Saddle River, NJ: Merrill Prentice Hall.
- Henkel, L. (2011). Photograph-induced memory errors: When photographs make people claim they have done things they have not. *Applied Cognitive Psychology*, 25, 78-86.
- Holmes, N. (1984). *Designer's guide to creating charts & diagrams*. New York: Watson-Guptill.
- Hooke, R. (1668). A Contrivance to Make the Picture of Any Thing Appear on a Wall, Cub-Board, or within a Picture-Frame, &c. in the Midst of a Light Room in the Day-Time; Or in the Night-Time in Any Room That is Enlightned with a Considerable Number of Candles; Devised and Communicated by the Ingenious Mr. Hook, as Follows. *Philosophical Transactions*, 3, 741-743.
- House, E. (1973). The conscience of educational evaluation. In E. House (Ed.), *School evaluation: The politics & process*. Berkeley, Ca.: McCutchan.
- Hoy, A. (2000). Educational psychology in teacher education. *Educational Psychologist*, 35(4), 257-270.
- Hsieh, P., Acee, T., Chung, W., Hsieh, Y., Kim, H., Thomas, G. D., et al. (2005). Is educational intervention research on the decline? *Journal of Educational Psychology*, 97(4), 523-529.
- HUDCETT (2010). OurSubject. Retrieved 8 October 2012, from Huddersfield University: <http://oursubject.hud.ac.uk/>
- Huhmann, B. A. (2008). A model of the cognitive and emotional processing of rhetorical works in advertising. In E. F. McQuarrie & B. J. Phillips (Eds.), *Go figure! New directions in advertising rhetoric* (pp. 85-113). New York: M. E. Sharpe.
- Hutchinson, T. (Ed.). (1964). *The poetical works of Wordsworth*. London: Oxford University Press.
- Intraub, H., & Hoffman, J. E. (1992). Reading and visual memory: Remembering scenes that were never there. *American Journal of Psychology*, 105(1), 101-114.
- James, K. E., Burke, L. A., & Hutchins, H. M. (2006). Powerful or pointless? Faculty versus student perceptions of PowerPoint use in business education. *Business Communications Quarterly*, 69(4), 374-396.

- James, W. (1890). *The principles of psychology*. New York: Henry Holt.
- Jevremovic, T. (2009). *Nuclear principles in engineering*. New York: Springer.
- JISC (2009). Pedagogical uses of presentation software. Retrieved 12 October, 2011, from <http://www.jiscdigitalmedia.ac.uk/crossmedia/advice/pedagogical-uses-of-presentation-software>
- Johnson, M. K., & Raye, C. L. (1981). Reality monitoring. *Psychological Review*, 88(1), 67-85.
- Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14-26.
- Jonassen, D. H., & Grabowski, B. L. (2011). *Handbook of individual differences, learning, and instruction*. New York: Routledge.
- Jones, A. M. (2003). The use and abuse of PowerPoint in teaching and learning in the life sciences: A personal overview. *Bioscience Education*, 2.
- Jones, C. (2004). *Quantitative and qualitative research: Conflicting paradigms or perfect partners?*. Paper presented at the Networked Learning 2004: A Research Based Conference on E-Learning in Higher Education and Lifelong Learning, Lancaster University.
- Joyce, J. (1937). *Ulysses*. London: Bodley Head.
- Kalyuga, S., Ayres, P., Chandler, P., & Sweller, J. (2003). Expertise reversal effect. *Educational Psychologist*, 38, 23-31.
- Kalyuga, S., Chandler, P., & Sweller, J. (1998). Levels of expertise and instructional design. *Human Factors*, 40, 1-17.
- Kalyuga, S., Chandler, P., & Sweller, J. (2004). When redundant on-screen text in multimedia technical instruction can interfere with learning. *Human Factors*, 46(3), 567-581.
- Kane, R., Sandretto, S., & Heath, C. (2002). Telling half the story: A critical review of research on the teaching beliefs and practices of university academics. *Review of Educational Research*, 72(2), 177-228.
- Karrer, T. (2012). What's wrong with traditional stock photography sources for elearning? *elearning Technology* Retrieved 13 July, 2012, from <http://elearningtech.blogspot.co.uk/2012/06/what-wrong-with-traditional-stock.html>
- Kellog, R. T., Olive, T., & Piolat, A. (2007). Verbal, visual, and spatial working memory in written language production. *Acta Psychologica*, 124, 382-397.
- Kendon, A. (2004). *Gesture: Visible action as utterance*. Cambridge: Cambridge University Press.
- Kiefer, M., & Pulvermuller, F. (2011). Conceptual representations in mind and brain: Theoretical developments, current evidence and future directions. *Cortex*, 1-21
- Kiewra, K. A. (1989). A review of note-taking: The encoding-storage paradigm and beyond. *Educational Psychology Review*, 1, 147-172.
- Kinchin, I. (2006). Developing PowerPoint handouts to support meaningful learning. *British Journal of Educational Technology*, 37(4), 647-650.
- Kirby, J. R. (1993). Collaborative and competitive effects of verbal and spatial processes. *Learning and Instruction*, 3, 201-214.
- Kirkwood, R. (1988). *Looking for happiness*. London: Longman.
- Kitzinger, J. (1994). Focus groups: Method or madness? In M. Boulton (Ed.), *Challenge and innovation: Methodological advances in social research on HIV/AIDS*. London: Taylor & Francis.
- Kitzinger, J., & Barbour, R. (1999). Introduction: The challenge and promise of focus groups. In R. Barbour & J. Kitzinger (Eds.), *Developing focus group research*. London: Sage.
- Klein, S. (2002). *The science of happiness: How our brains make us happy - and what we can do to get happier*. Hamburg: Rowohlt Verlag
- Knauff, M., & Johnson-Laird, P. N. (2002). Visual imagery can impede reasoning. *Memory & Cognition*, 30(3), 363-371.
- Knobloch, S., Hastall, M., Zillman, D., & Callison, C. (2003). Imagery effects on the selective reading of internet newsmagazines. *Communication Research*, 30(1), 3-29.
- Koeber, C. (2005). Introducing multimedia presentations and a course website to an introductory sociology course: How technology affects student perceptions of teaching effectiveness. *Teaching Sociology*, 33, 285-300.
- Kolb, D. A. (1976). *The learning style inventory: Technical manual*. Boston, MA: McBer.
- Konigs, K. D., Brand-Gruwel, S., & Van Merriënboer, J. J. G. (2007). Teachers' perspectives on innovations: Implications for educational design. *Teaching and Teacher Education*, 23, 985-997.
- Kosslyn, S. M. (1980). *Image and mind*. Cambridge, Mass: Harvard University Press.

- Kosslyn, S. M. (2003). What shape are a German Shepherd's ears? In J. Brockman (Ed.), *The new humanists: Science at the edge* (pp. 125-143). New York: Barnes & Noble Books.
- Kosslyn, S. M. (2005). Mental images and the brain. *Cognitive Neuropsychology*, 22(3/4), 333-347.
- Kosslyn, S. M. (2006). *Graph design for the eye and mind*. New York: Oxford University Press.
- Kosslyn, S. M. (2007a). *Clear and to the point: Eight psychological principles for compelling PowerPoint presentations*. New York: Oxford University Press.
- Kosslyn, S. M. (2007b). Remembering Images. In M. A. Gluck, J. R. Anderson & S. M. Kosslyn (Eds.), *Memory and mind: A festschrift for Gordon H. Bower*. Hillsdale, NJ: Erlbaum Associates.
- Kosslyn, S. M., Ganis, G., & Thompson, W. L. (2001). Neural foundations of imagery. *Nature Reviews. Neuroscience*, 2(9), 635-642.
- Kosslyn, S. M., Ganis, G., & Thompson, W. L. (2006). Mental imagery and the brain. In Q. R. Jing, M. R. d'Ydewalle, G., H. Zhang, H. Chen & K. Zhang (Eds.), *Progress in psychological science around the world, vol. 1: Neural, cognitive and developmental issues* (pp. 195-209). London: Psychology Press.
- Kosslyn, S. M., Kievit, R. A., Russell, A. G., & Shephard, J. M. (2012). PowerPoint presentation flaws and failures: A psychological analysis. *Frontiers in Psychology*, 3, 1-22.
- Kosslyn, S. M., & Moulton, S. T. (2009). Mental imagery and implicit memory. In K. D. Markman, W. M. P. Klein & J. A. Suhr (Eds.), *Handbook of imagination and mental simulation* (pp. 135-151). New York: Hove.
- Kosslyn, S. M., & Thompson, W. L. (2000). Shared mechanisms in visual imagery and visual perception: Insights from cognitive neuroscience. In M. S. Gazzaniga (Ed.), *The new cognitive neurosciences* (2nd ed., pp. 975-985). Cambridge: MIT Press.
- Kosslyn, S. M., & Thompson, W. L. (2003). When is early visual cortex activated during visual mental imagery? *Psychological Bulletin*, 129(5), 723-746.
- Kousta, S., Vigliocco, G., Vinson, D., Andrews, M., & Del Campo, E. (2011). The representation of abstract words: Why emotion matters. *Journal of Experimental Psychology: General*, 140(1), 14-34.
- Kozhevnikov, M., Blazhenkova, O., & Becker, M. (2010). Trade-off in object versus spatial visualisation abilities: Restriction in the development of visual-processing resources. *Psychonomic Bulletin & Review*, 17(1), 29-35.
- Kozhevnikov, M., Hegarty, M., & Mayer, R. E. (2002). Revising the visualiser-verbaliser dimension: Evidence for two types of visualisers. *Cognition and Instruction*, 20(1), 47-77.
- Kozhevnikov, M., Kosslyn, S. M., & Shepard, J. (2005). Spatial versus object visualisers: A new characterisation of visual cognitive style. *Memory & Cognition*, 33(4), 710-726.
- Kozhevnikov, M., Louchakova, O., Josipovic, Z., & Motes, M. A. (2009). The enhancement of visuaspatial processing efficiency through Buddhist deity meditation. *Psychological Science*, 20(5), 645-653.
- Kress, G., & van Leeuwen, T. (1996). *Reading images: The grammar of visual design*. London: Routledge.
- Kress, G., & van Leeuwen, T. (2006). *Reading images: The grammar of visual design* (2nd ed.). Abingdon: Routledge.
- Kreuger, R. A. (1993). Quality control in focus group research. In D. L. Morgan (Ed.), *Successful focus groups: Advancing the state of the art*. Newbury Park, CA: Sage.
- Kueter, R. A., & Miller, J. (1981). *The instructional media library no13: Slides*. Eaglewood Cliffs, NJ: Educational Technology Publications.
- Kuipers, J. C., & Clemens, D. L. (1998). Do I dare? Using role play as a teaching strategy. *Journal of Psychosocial Nursing & Mental Health Services*, 36(7), 12-17.
- Kulhavy, R. W., Lee, J. B., & Caterino, L. C. (1985). Conjoint retention of maps and related discourse. *Contemporary Educational Psychology*, 10, 28-37.
- Kunkel, K. R. (2004). A research note assessing the benefit of presentation software in two different lecture courses. *Teaching Sociology*, 32, 188-196.
- Kupsch, J., & Graves, P. R. (1998). *Create high impact business presentations*. Chicago: NTC LearningWorks.
- Kvale, S. (1996). *Interviews: An introduction to qualitative research interviewing*. Thousand Oaks, CA: Sage.
- Kvale, S. (2007). *Doing interviews*. London: Sage.
- Lacey, S., Stilla, R., & Sathian, K. (2012). Metaphorically feeling: Comprehending textual metaphors activates somatosensory cortex. *Brain and Language*, 120(3), 416-421.
- Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: University of Chicago Press.

- Lane, R., & Wright, R. (2010). And the research says? PowerPoint meets cognitive science. Retrieved 3 June, 2010, from <http://office.microsoft.com/en-us/powerpoint-help/and-the-research-says-powerpoint-meets-cognitive-science-HA010198311.aspx>
- Langer, S. K. (1957). *Philosophy in a new key* (3rd ed.). London: Oxford University Press.
- LaPorte, R. E., Linkov, F., Villaseñor, A., Sauer, F., Gamboa, C., Lovalekar, M., et al. (2002). Papyrus to PowerPoint (P 2 P): Metamorphosis of scientific communication. *British Medical Journal*, 325, 1478-1481.
- Larkin, J. H., & Simon, H. A. (1987). Why a diagram is (sometimes) worth ten thousand words. *Cognitive Science*, 11, 65-99.
- Laurillard, D. (2002). *Rethinking university education* (2nd ed.). London: Routledge Falmer.
- Laurillard, D., Masterman, E., Ljubojevic, D., Manton, M., Craft, B., Wild, J., et al. (2012). Using digital technologies to support teachers in designing effective technology-enhanced learning (TEL) Retrieved 8 October, 2012, from <https://sites.google.com/a/lkl.ac.uk/ldse/>
- Leahy, W., & Sweller, J. (2005). Interactions among the imagination, expertise reversal, and element interactivity effects. *Journal of Experimental Psychology: Applied*, 11(4), 266-276.
- Leahy, W., & Sweller, J. (2008). The imagination effect increases with an increased intrinsic cognitive load. *Applied Cognitive Psychology*, 22, 273-283.
- Leahy, W., & Sweller, J. (2011). Cognitive load theory, modality of presentation and the transient information effect. *Applied Cognitive Psychology*, 25, 943-951.
- Lee, J., Forlizzi, J., & Hudson, S. E. (2002). *The kinetic typography engine: An extensible system for animating expressive text*. Paper presented at the Proceedings of the 15th annual ACM symposium on user interface software and technology, New York.
- Leeds, U. o. (2011). Learning styles recap. Retrieved 12 October, 2011, from http://www.leeds.ac.uk/medicine/prof_dev/free/Designing%20E-learning%20-%20Learner%20and%20Context_HTML/page_05.htm
- Lengler, R., & Eppler, M. J. (2007). *Towards a periodic table of visualisation methods for management*. Paper presented at the Conference on Graphics and Visualization in Engineering. Clearwater, FL. from http://www.visual-literacy.org/periodic_table/periodic_table.pdf (Accessed 10 January 2012)
- Lester, P. M. (1999). *Visual communication: Images with messages*. Belmont, CA: Thomson Wadsworth.
- Levasseur, D. G., & Kanan Sawyer, J. (2006). Pedagogy meets PowerPoint: A research review of the effects of computer-generated slides in the classroom. *Review of Communication*, 6(1-2), 101-123.
- Levie, W. H. (1987). Research on pictures: A guide to the literature. In D. M. Willows & H. A. Houghton (Eds.), *The psychology of illustration* (Vol. 1). New York: Springer-Verlag.
- Levie, W. H., & Lentz, R. (1982). Effects of text illustrations: A review of research. *Educational Communication and Technology Journal*, 30(4), 195-232.
- Levin, J. R. (1981). On functions of pictures in prose In F. J. Pirozzolo & M. C. Wittrock (Eds.), *Neuropsychological and cognitive processes in reading*. New York: Academic Press.
- Levin, J. R., & O'Donnell, A. M. (1999). What to do about educational research's credibility gaps? *Issues in Education*, 5(2), 177-229.
- Lewandowsky, L. J., & Kobus, D. A. (1993). The effects of redundancy in bimodal word processing. *Human Performance*, 6(3), 229-239.
- Lewicki, P. (1985). Nonconscious biasing effects of single instances on subsequent judgements. *Journal of Personality and Social Psychology*, 48(3), 563-574.
- Lin, L., & Atkinson, R. K. (2011). Using animations and visual cueing to support learning of scientific concepts and processes. *Computers & Education*, 56, 650-658.
- Lincoln, Y., & Guba, E. (1985). *Naturalistic inquiry*. Beverly Hills, CA.: Sage.
- Lincoln, Y. S. (2006). *Research libraries as knowledge producers: A shifting context for policy and funding* (Presentation to ARL Membership Meeting, October 18 2006).
- Lipert, S. (2005). Gustan Moreau and the Paragone: A painter's challenge to a new breed of art critic. In L. Boldt-Irons, C. Federici & E. Virgulti (Eds.), *Images and imagery: Frames, borders, limits: Interdisciplinary perspectives* (pp. 45-78). New York: Peter Lang.
- Liverpool, U. o. (2011). VARK Questionnaire. Retrieved 12 October, 2011, from <http://ftp.liv.ac.uk/pub/apboyle/VARK/VARK-questionnaire.pdf>
- Logie, R. H., Della Salla, S., Wynn, V., & Baddeley, A. D. (2000). Visual similarity effects in immediate verbal serial recall. *Quarterly Journal of Experimental Psychology*, 53(3), 626-646.
- Lohr, L. L. (2003). *Creating graphics for learning and performance: Lessons in visual literacy*. Upper Saddle River, NJ: Pearson Education.

- Lortie, D. C. (1975). *Schoolteacher: A sociological study*. Chicago: University of Chicago Press.
- Lowry, R. B. (1999). Electronic presentation of lectures - Effect upon student performance. *University Chemistry Education*, 3(1), 18-21.
- Mackenzie, N., & Knipe, S. (2006). Research dilemmas: Paradigms, methods and methodology. *Issues in Educational Research*, 16(2), 193-205.
- Macoir, J. (2009). Is a plum a memory problem? Longitudinal study of the reversal of concreteness effect in a patient with semantic dementia. *Neuropsychologica*, 47, 518-535.
- Mann, S., & Robinson, A. (2009). Boredom in the lecture theatre: An investigation into the contributors, moderators and outcomes of boredom amongst university students. *British Educational Research Journal*, 35(2), 243-258.
- Mannoni, L. (2000). *The great art of light and shadow*. Exeter: University of Exeter Press.
- Marks, D. F. (1973). Visual imagery differences in the recall of pictures. *British Journal of Psychology*, 64(1), 17-24.
- Marx, E., Deutschlander, A., Stephan, T., Dieterich, M., Wiesmann, M., & Brandt, T. (2004). Eyes open and eyes closed as rest conditions: Impact on brain activation patterns. *Neuroimage* 21, 1818-1824.
- Massa, L. J., & Mayer, R. E. (2006). Testing the ATI hypothesis: Should multimedia instruction accommodate verbaliser-visualiser cognitive style? *Learning and Individual Differences*, 16, 321-335.
- Massaro, D. W. (1998). *Perceiving talking faces: From speech perception to a behavioral principle*. Cambridge, MA: MIT Press.
- Matson, J. (2009, 2 August). Al Gore nabs elusive award triple crown: Oscar, Nobel, Grammy. <http://www.scientificamerican.com/blog/post.cfm?id=al-gore-nabs-elusive-award-triple-c-2009-02-09>.
- Maxcy, S. (2003). Pragmatic threads in mixed methods research in the social sciences: The search for multiple modes of enquiry and the end of the philosophy of formalism. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social & behavioural research*. Thousand Oaks, CA: Sage.
- Maxwell, J. A. (1992). Understanding and validity in qualitative research. *Harvard Educational Review*, 62(3).
- Mayer, R. E. (1993). Illustrations that instruct. In R. Glaser (Ed.), *Advances in instructional psychology* (Vol. 4). Hillsdale, NJ: Erlbaum.
- Mayer, R. E. (2001). *Multimedia learning*. New York: Cambridge University Press.
- Mayer, R. E. (2005a). Cognitive theory of multimedia learning. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 31-48). New York: Cambridge University Press.
- Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). New York: Cambridge University Press.
- Mayer, R. E. (2010). Seeking a science of instruction. *Instructional Science*, 38, 143-145.
- Mayer, R. E. (Ed.). (2005b). *The Cambridge handbook of multimedia learning*. New York: Cambridge University Press.
- Mayer, R. E., & Gallini, J. (1990). When is an illustration worth ten thousand words? *Journal of Educational Psychology*, 82(4), 715-726.
- Mayer, R. E., Heiser, J., & Lonn, S. (2001). Cognitive constraints on multimedia learning: When presenting more material results in less understanding. *Journal of Educational Psychology*, 93(1), 187-198.
- Mayer, R. E., & Johnson, C. I. (2008). Revising the redundancy principle in multimedia learning. *Journal of Educational Psychology*, 100(2), 380-386.
- Mayer, R. E., & Moreno, R. (2002). Aids to computer-based multimedia learning. *Learning and Instruction*, 12, 107-119.
- Mayer, R. E., & Sims, V. (1994). For whom is a picture worth a thousand words? Extensions of a dual-coding theory of multimedia learning. *Journal of Educational Psychology*, 86(3), 389-401.
- McCabe, D. P., & Castel, A. B. (2008). Seeing is believing: The effect of brain images on judgements of scientific reasoning. *Cognition and Instruction*, 107, 343-352.
- McCandless, D. (2010). *Information is beautiful*. Glasgow: Collins.
- McGrath, J. E. (1982). Dilemmatics: The study of research choices and dilemmas. In J. E. McGrath, J. Martin & R. A. Kulka (Eds.), *Judgement calls in research*. Beverly Hills: Sage.
- McGurk, H., & MacDonald, J. (1976). Hearing lips and seeing voices. *Nature*, 264, 746-748.
- McKeachie, W. J. (1986). *Teaching tips: A guidebook for the beginning college teacher*. Lexington, MA: Heath & Co.
- McLuhan, M. (1964). *Understanding media*. New York: McGraw-Hill.

- Medford, N., Phillips, M. L., Brierley, B., Brammer, M., Bullmore, E. T., & David, A. S. (2005). Emotional memory: Separating content and context. *Psychiatry Research: Neuroimaging*, 138, 247-258.
- Meisel, M. (1983). *Realizations: Narrative, pictorial, and theatrical art in 19th-century England*. Princeton: Princeton University Press.
- Mertens, D. M. (2010). *Research and evaluation in education and psychology* (3rd ed.). Thousand Oaks, CA: Sage.
- Messaris, P. (1994). *Visual literacy: Image, mind, and reality*. Colorado: Westview Press.
- Messaris, P., & Moriarty, S. (2011). Visual literacy theory. In K. M. Smith, S. Kenney, K. Barbatsis, G. (Ed.), *Handbook of visual communication: Theory, methods, and media*. New York: Routledge.
- Microsoft (2011). Microsoft president announces new partner benefits and underscores opportunity with windows phone 'Mango'. *Microsoft News* Retrieved 20 August 2012, from <http://www.microsoft.com/en-us/news/features/2011/jul11/07-12windowsphone.aspx>
- Miles, M., & Huberman, A. (1994). *Qualitative Data Analysis* (2nd ed.). Thousand Oaks: Sage.
- Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review*, 63, 81-97.
- Miller, H. L. (1964). *Teaching and learning in adult education*. New York: MacMillan.
- Miller, M., & Campbell, D. T. (1959). Recency and primacy in persuasion as a function of the timing of speeches and measurements. *The Journal of Abnormal and Social Psychology*, 59(1), 1-9.
- Miller, P., & Eilam, B. (2008). Development in the thematic and containment-relation-oriented organization of word concepts. *Journal of Educational Research* 101(6), 350-362.
- Mitchell, W. J. T. (1986). *Iconology: Image, text, ideology*. Chicago: University of Chicago Press.
- Mitchell, W. J. T. (1994). *Picture theory*. Chicago: University of Chicago Press.
- Mitchell, W. J. T. (2008). Visual literacy or literary visualcy? In J. Elkins (Ed.), *Visual literacy*. New York: Routledge.
- Mondfrans, A. P., & Travers, R. M. (1964). Learning of redundant material presented through two sensory modalities. *Perceptual and Motor Skills*, 19, 743-751.
- Moons, W. G., Mackie, D. M., & Garcia-Marques, T. (2009). The impact of repetition-induced familiarity on agreement with weak and strong arguments. *Journal of Personality and Social Psychology*, 96(1), 32-44.
- Moreno, R., & Mayer, R. E. (2002). Verbal redundancy in multimedia learning: When reading helps listening. *Journal of Educational Psychology*, 94(1), 156-163.
- Morgan, D. L. (1998a). *The focus group guidebook*. Thousand Oaks, CA: Sage.
- Morgan, D. L. (1998b). *Planning focus groups*. London: Sage.
- Morley, A., Atherton, C., & Oulton, N. (2012). *Improving memory for presentation material through visual cognitive dissonance: A comparison of m62 designed presentations to the "next best alternative"*: University of Central Lancashire.
- Moro, V., Berlucchi, G., Lerch, J., Tomaiuolo, F., & Aglioti, S. M. (2008). Selective deficit of mental visual imagery with intact primary visual cortex and visual perception. *Cortex*, 44, 109-118.
- Morrison, D. (Ed.). (2010). *The Cambridge companion to Socrates*. London: Cambridge University Press.
- Mousavi, S. Y., Low, R., & Sweller, J. (1995). Reducing cognitive load by mixing auditory and visual presentation modes. *Journal of Educational Psychology*, 87(2), 319-334.
- Murdock, B. B. (1962). The serial position effect of free recall. *Journal of Experimental Psychology* 62, 482-488.
- Murray, K., & MacDonald, R. (1997). The disjunction between lecturers' conceptions of teaching and their claimed educational practice. *Higher Education*, 33, 331-349.
- Naftulin, D. H., Ware, J. E., & Donnelly, F. A. (1973). The Doctor Fox lecture: A paradigm of educational seduction. *Journal of Medical Education*, 48, 630-635.
- Neef, N. A., McCord, B. E., & Ferreri, S. J. (2006). Effects of guided notes versus completed notes during lectures on college students' quiz performance. *Journal of Applied Behaviour Analysis*, 39(1), 123-130.
- Nelson, D. L., Reed, V. S., & Walling, J. R. (1976). Pictorial superiority effect. *Journal of Experimental Psychology: Human Learning and Memory*, 2(5), 523-528.
- Nemko, M. (2007). The college grad's career kit: Commencement clichés, debunked. *US News & World Report*. Retrieved from <http://www.usnews.com/usnews/biztech/articles/070404/4collegecareer.intro.htm>
- Newman, E. J., Garry, M., Bernstein, D. M., Kantner, J., & Lindsay, D. S. (2012). Non-probative photographs (or words) inflate truthiness. *Psychonomic Bulletin & Review*, 19(5), 969-974.

- Norton, L., Richardson, J. T. E., Hartley, J., Newstead, S., & Mayes, J. (2005). Teachers' Beliefs and Intentions concerning Teaching in Higher Education. *Higher Education*, 50(4), 537-571.
- O'Caithan, A., Murphy, E., & Nicholl, J. (2007). Why, and how, mixed methods research is undertaken in health services research in England: A mixed methods study (Publication no. 10.1186/1472-6963-7-85). Retrieved 22 July 2009:
- OED (Ed.) (2011) Oxford English Dictionary. Oxford: Oxford University Press.
- Oishi, S. M. (2003). *How to conduct in-person interviews for surveys* (2nd ed.). Thousand Oaks, CA: Sage.
- Olivarez-Giles, N. (2011, 5 August 2011). Flickr reaches 6 billion photos uploaded. *The Los Angeles Times*. from <http://latimesblogs.latimes.com/technology/2011/08/flickr-reaches-6-billion-photos-uploaded.html>.
- Oppenheim, A. N. (1992). *Questionnaire design, interviewing and attitude measurement*. London: Routledge.
- Paivio, A. (1971). *Imagery and verbal processes*. New York: Holt, Rinehart & Winston.
- Paivio, A. (1979). *Imagery and verbal processes*. New Jersey: Lawrence Erlbaum.
- Paivio, A. (1982). The empirical case for dual coding. In J. C. Yuille (Ed.), *Imagery, memory and cognition, essays in honour of Allan Paivio*. New Jersey: Lawrence Erlbaum.
- Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review*, 3(3), 149-210.
- Paivio, A. (2007). *Mind and its evolution*. Mahwah, N.J.: Lawrence Erlbaum.
- Paivio, A. (2013). Dual coding theory, word abstractness, and emotion: A critical review of Kousta et al. (2011). *Journal of Experimental Psychology: General*, 142(1), 282-287.
- Paivio, A., & Csapo, K. (1973). Picture superiority in free recall: Imagery or dual coding? *Cognitive Psychology*, 5, 176-206.
- Paivio, A., Rogers, T. B., & Smythe, P. C. (1968). Why are pictures easier to recall than words? *Psychonomic Science*, 11(4), 137.
- Parker, I. (2001, 28 May 2001). Absolute PowerPoint: Can a software package edit our thoughts? *The New Yorker*.
- Parks, R. (1999). Macro principles, PowerPoint, and the internet: Four years of the good, the bad, and the ugly. *Journal of Economic Education*, 30(3), 200-209.
- Pashler, H., McDaniel, M., Rohrer, D., & Bjork, R. (2009). Learning styles: Concepts and evidence. *Psychological Science in the Public Interest*, 9(3), 105-119.
- Pastore, R. S. (2003). Dale's cone of experience. Retrieved 10 January, 2011, from <http://teacherworld.com/potdale.html>
- Pearson, D. G. (2001). Imagery and the visuo-spatial sketchpad. In J. Anrade (Ed.), *Working memory in perspective*. Hove: Psychology Press.
- Peeck, J. (1989). Trends in the delayed use of information from an illustrated text. In H. Mandl & J. R. Levin (Eds.), *Knowledge acquisition from text and pictures*. Amsterdam: Elsevier.
- Pena, B. M., & Quilez, M. J. (2001). The importance of images in astronomy education. *International Journal of Science Education*, 23(11), 1125-1135.
- Penney, C. G. (1989). Modality effects and the structure of short term memory. *Memory & Cognition* 17(4), 398-422.
- Perky, C. W. (1910). An experimental study of imagination. *American Journal of Psychology*, 21, 422-452.
- Peterson, E., Rayner, S. G., & Armstrong, S. J. (2009). Researching the psychology of cognitive style and learning style: Is there really a future? *Learning and Individual Differences*, 19, 518-523.
- Petty, G. (2009). *Evidence-based teaching: A practical approach* (2nd ed.). Cheltenham: Nelson Thornes.
- Piolat, A., Thierry, O., & Kellog, R. T. (2005). Cognitive effort during note taking. *Applied Cognitive Psychology*, 19, 201-392.
- Pippert, T. D., & Moore, H. A. (1999). Multiple perspectives on multimedia in the large lecture theatre. *Teaching Sociology*, 27, 92-109.
- Plass, J. L., Kalyuga, S., & Leutner, D. (2010). Individual differences and cognitive load theory. In J. L. Plass, R. Moreno & R. Brunken (Eds.), *Cognitive load theory*. New York: Cambridge University Press.
- Plass, J. L., Moreno, R., & Brunken, R. (2010). *Cognitive load theory*. New York: Cambridge University Press.
- Playfair, W. (1801). *The commercial and political atlas*. London: J. Wallis.
- Polgar, S., & Thomas, S. A. (2008). *Introduction to research in the health sciences*. London: Elsevier.

- Powney, J. (1988). Structured eavesdropping. *Research Intelligence (Journal of the British Educational Research Foundation)*, 28, 10-12.
- Pozzer-Ardenghi, L., & Roth, W. M. (2005). Photographs in lectures: Gestures as meaning-making resources. *Linguistics and Education*, 15, 275-293.
- Prabu, D. (1998). News concreteness and visual-verbal association: Do news pictures narrow the recall gap between concrete and abstract news? *Human Communication Research*, 25(2), 180-201.
- Prabu, D., & Jagdeep, K. (1998). Pictures, high-imagery news language and news recall. *Newspaper Research Journal*, 19(3), 21-30.
- Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon* 9(5).
- Pring, R. (2004). *Philosophy of educational research*. London: Continuum.
- Pritchard, A. (2009). *Ways of learning: Learning styles and learning theories in the classroom*. Abingdon: Routledge.
- Pylyshyn, Z. W. (1973). What the mind's eye tells the mind's brain: A critique of mental imagery. *Psychological Bulletin*, 80, 1-25.
- Pylyshyn, Z. W. (2003). Return of the mental image: Are there really pictures in the brain? *Trends in Cognitive Sciences*, 7(3), 113-118.
- Race, P. (2010). *In at the deep end: Starting to teach in higher education*. Exeter: University of Exeter.
- Reid, G. (2005). *Learning styles and inclusion*. London: Sage.
- Reid, J. M. (1987). The learning style preferences of ESL students. *TESOL Quarterly*, 21(1), 87-110.
- Reissman, C. K. (1993). *Narrative Analysis*. Newbury Park CA: Sage.
- Reynolds, G. (2005a, 2 October). The "Lessig Method" of presentation. http://presentationzen.blogspot.com/presentationzen/2005/10/the_lessig_meth.html.
- Reynolds, G. (2005b, 14 March). Living large: "Takahashi Method" uses king-sized text as a visual. http://presentationzen.blogspot.com/presentationzen/2005/09/living_large_ta.html.
- Ricer, R. E., Filak, A. T., & Short, J. (2005). Does a high tech (computerized, animated, PowerPoint) presentation increase retention of material compared to a low tech (black on clear overheads) presentation? *Teaching and Learning in Medicine*, 17(2), 107-111.
- Richardson, A. (1977). Verbaliser-visualiser: A cognitive style dimension. *Journal of Mental Imagery*, 1, 109-125.
- Richardson, J. T. E. (1985). Integration versus decomposition in the retention of complex ideas. *Memory & Cognition*, 13(2), 112-127.
- Richardson, J. T. E. (1987). Social class limitations on the efficacy of imagery mnemonic instructions. *British Journal of Psychology*, 78(1), 65-67.
- Richardson, J. T. E. (1999). *Imagery*. Hove: Psychology Press.
- Richardson, J. T. E., & Rossan, S. (1994). Age limitations on the efficacy of imagery mnemonic instructions. *Journal of Mental Imagery*, 18, 151-164.
- Riding, R. J. (1991). *Cognitive styles analysis*. Birmingham: Learning and Training Technology.
- Riding, R. J., & Douglas, G. (1993). The effect of cognitive style and mode of presentation on learning performance. *British Journal of Educational Psychology*, 6, 297-307.
- Riding, R. J., Grimley, M., Dahraei, H., & Banner, G. (2003). Cognitive style, working memory and learning behaviour and attainment in school subjects. *British Journal of Educational Psychology*, 73, 149-169.
- Robinson, W. (2004). *Power to teach: Learning through practice*. London: Routledge Falmer.
- Robson, C. (2002). *Real world research* (2nd ed.). Oxford: Blackwell.
- Rocco, T. S., Bliss, L. A., Gallagher, S., Perez-Prado, A., Alacaci, C., Dwyer, E. S., et al. (2003). The pragmatic and dialectical lenses: Two views of mixed methods used in education. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social & behavioural research*. Thousand Oaks, CA.: Sage.
- Roderique-Davies, G. (2009). Neuro-linguistic programming: Cargo cult psychology. *Journal of Applied Research in Higher Education*, 1(2), 57-63.
- Roediger, H. L. (2013). Applying cognitive psychology to education: Translational educational science. *Psychological Science in the Public Interest*, 14(1), 1-3.
- Roehling, P. V., & Trent-Brown, S. (2011). Differential use and benefits of PowerPoint in upper level versus lower level courses. *Technology, Pedagogy and Education*, 20(1), 113-124.
- Rogers, T. B., Kuiper, N. A., & Kirker, W. S. (1977). Self-reference and the encoding of personal information. *Journal of Personality and Social Psychology*, 39(9), 677-688.
- Rohrer, T. (2005). Image schemata in the brain. In B. Hampe & J. E. Grady (Eds.), *From perception to meaning: Image schemas in cognitive linguistics* (pp. 165-196). Berlin: Mouton de Gruyter.

- Rose, C. (1985). *Accelerated learning*. Aylesbury: Accelerated Learning Systems.
- Rosling, H. (2011). Gapminder. Retrieved 25 July, 2011, from www.gapminder.org
- Ross, L., Greene, D., & House, P. (1977). The false consensus effect: An egocentric bias in social perception and attribution processes. *Journal of Experimental Social Psychology*, 13(3), 279-301.
- Roth, W.-M., McGinn, M. K., & Bowen, G. M. (1998). How prepared are preservice teachers to teach scientific inquiry? Levels of performance in scientific representation practices. *Journal of Science Teacher Education* 9(1), 25-48.
- Rudd, N. (Ed.). (1989). *Horace: Epistles book II: And epistle to the Pisones (Ars poetica)*. Cambridge: Cambridge University Press
- Rummer, R., Schwelpe, J., Furstenberg, A., Seufert, T., & Brunken, R. (2010). Working memory interference during processing texts and pictures: Implications for the explanation of the modality effect. *Applied Cognitive Psychology*, 24, 164-176.
- Ryle, G. (1949). *The concept of mind*. New York: Barnes & Noble.
- Sadoski, M. (2001). Resolving the effects of concreteness on interest, comprehension, and learning important ideas from text. *Educational Psychology Review*, 13(3), 263-281.
- Sadoski, M., Goetz, E. T., & Fritz, J. B. (1993). The impact of concreteness on comprehensibility, interest, and memory for text: Implications for dual coding theory and text design. *Journal of Educational Psychology*, 85, 291-304.
- Sadoski, M., & Paivio, A. (2004). A dual coding theoretical model of reading In R. B. Ruddell & N. J. Unrau (Eds.), *Theoretical models and processes of reading* (5th ed., pp. 1329-1362). Newark, DE: International reading Association.
- Saks, M., & Allsop, J. (2007). *Researching health: Qualitative, quantitative and mixed methods*. London: Sage.
- Sassoon, S. (1928). *Memoirs of a fox-hunting man*. London: Faber and Faber.
- Savoy, A., Proctor, R. W., & Salvendy, G. (2009). Information retention from PowerPoint and traditional lectures. *Computers & Education*, 52(4), 858-867.
- Schaffer, L. H. (1975). Multiple attention in continuous verbal tasks. In P. M. A. Rabbitt & S. Dornic (Eds.), *Attention and performance V* (pp. 157-167). London: Academic Press.
- Schnotz, W. (2001). Sign systems, technologies, and the acquisition of knowledge. In J.-F. Rouet, J. J. Levonen & A. Biardeau (Eds.), *Multimedia learning - cognitive and instructional issues*. Oxford: Elsevier.
- Schnotz, W. (2005). An integrated model of text and picture comprehension. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning*. New York: Cambridge University Press.
- Schnotz, W., & Bannert, M. (2003). Construction and interference in learning from multiple representation. *Learning and Instruction*, 13, 141-156.
- Schnotz, W., & Kurschner, C. (2007). A reconsideration of cognitive load theory. *Educational Psychology Review*, 19(4), 469-508.
- Schofield, J. W. (1990). Increasing the generalisability of qualitative research. In E. W. Eisner & A. Peshkin (Eds.), *Qualitative enquiry in education*. New York: Teachers College Press.
- Schwaborn, A., Thillmann, H., Opfermann, M., & Leutner, D. (2011). Cognitive load and instructionally supported learning with provided and learner-generated visualisations. *Computers in Human Behaviour*, 27, 89-93.
- Schwanenflugel, P. J. (1991). Why are abstract concepts hard to understand? In P. J. Schwanenflugel (Ed.), *The psychology of word meanings*. Hillsdale, N.J.: Lawrence Erlbaum.
- Seligman, M. E. P. (2002). *Authentic happiness*. New York: Simon & Schuster.
- Severin, W. J. (1967). Another look at cue summation. *AV Communication Review*, 15, 233-245.
- Sharp, J. G., Bowker, R., & Byrne, J. (2008). VAK or VAK-uous? Towards the trivialisation of learning and the death of scholarship. *Research Papers in Education*, 23(3), 293-314.
- Shaw, G. (2011). Cartoon training, from www.grahamshaw.net
- Shepard, R. N., & Metzler, J. (1971). Mental rotation of three-dimensional objects. *Science*, 171, 701-703.
- Shepherd, C. (2007). Clear and to the point. *Clive on Learning* Retrieved December 14, 2011, from <http://clive-shepherd.blogspot.co.uk/2007/10/clear-and-to-point.html#!/2007/10/clear-and-to-point.html>
- Sherwin, R. K. (2008). Visual literacy in action: "Law in the age of images". In J. Elkins (Ed.), *Visual literacy*. New York: Routledge.
- Shiffrin, S. (2008). Visual literacy in North American secondary schools: Arts-centered learning. In J. Elkins (Ed.), *Visual literacy*. New York: Routledge.

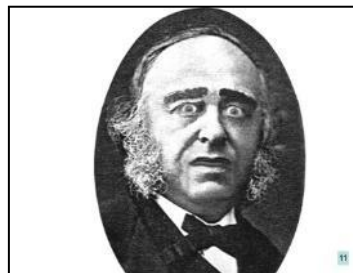
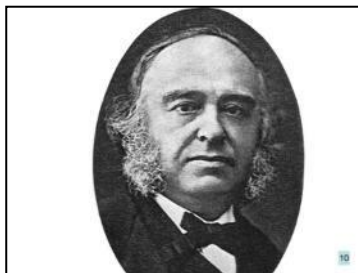
- Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, 15, 4-14.
- Sillars, S. (1995). *Visualisation in popular fiction 1860-1960*. London: Routledge.
- Silverman, D. (2005). *Doing qualitative research*. London: Sage.
- Sim, J. (1998). Collecting and analysing qualitative data: Issues raised by the focus group. *Journal of Advanced Nursing*, 28(2), 345-352.
- Simon, C. (2013, 10 February 2013). How many slides do people really remember? Retrieved 10 February, 2013, from <http://www.reximedia.com/Portals/67770/docs/whitepaper.pdf>
- Sitzmann, T., Brown, K. G., Casper, W. J. E., K., & Zimmerman, R. D. (2008). A review and meta-analysis of the nomological network of trainee reactions. *Journal of Applied Psychology*, 93(2), 280-295.
- Sless, D. (1981). *Learning and visual communication*. London: Croom Helm.
- Slykhuis, D. A., Wiebe, E. N., & Annetta, L. A. (2005). Eye-tracking students' attention to PowerPoint photographs in a science education setting. *Journal of Science Education and Technology*, 14(5/6), 509-520.
- Smith, A. (1996). *Accelerated learning in the classroom*. Stafford: Network Educational Press.
- Smith, A. (1998). *Accelerated learning in practice*. Stafford: Network Educational Press.
- Southampton, U. o. (2003). Understanding your learning style. Retrieved 10 January, 2012, from www.studyskills.soton.ac.uk/studyguides/learning%20Styles.doc
- Stafford, B. M. (1997). Think again: The intellectual side of images. *The Chronicle of Higher Education*, 43, B6-7.
- Stewart, B. M., Cipolla, J. M., & Best, L. A. (2009). Extraneous information and graph comprehension: Implications for effective design choices. *Campus-Wide Information Systems*, 26(3), 191-200.
- Stokes, D., & Bergin, R. (2006). Methodology or "methodolatory"? An evaluation of focus groups and depth interviews. *Qualitative Market Research: An International Journal*, 9(1), 26-37.
- Stull, A. T., & Mayer, R. E. (2007). Learning by doing versus learning by viewing: Three experimental comparisons of learner-generated versus author-provided graphic organisers. *Journal of Experimental Psychology*, 99(4), 808-820.
- Susskind, J. E. (2005). PowerPoint's power in the classroom: Enhancing students' self efficacy and attitudes. *Computers & Education*, 45(2), 203-215.
- Svinicki, M., & McKeachie, W. J. (2011). *McKeachie's teaching tips: Strategies, research, and theory for college and university teachers* (13th ed.). Belmont, CA: Wadsworth, Cengage Learning.
- Sweller, J. (2005). The redundancy principle in multimedia learning. In R. E. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 159-167). New York: Cambridge University Press.
- Sweller, J., van Merriënboer, J. J. G., & Paas, F. (1998). Cognitive architecture and instructional design. *Educational Psychology Review*, 10(3), 251-296.
- Szabo, A., & Hastings, N. (2000). Using IT in the undergraduate classroom: Should we replace the blackboard with PowerPoint? *Computers & Education*, 35, 175-187.
- Tabachneck-Schijf, H. J. M., & Simon, H. A. (1996). Alternative representations of instructional material. In D. Peterson (Ed.), *Forms of representation*. Exeter: Intellect Books.
- Tangen, J. M., Constable, M. D., Durrant, E., Teeter, C., Beston, B. R., & Kim, J. A. (2011). The role of interest and images in slideware presentations. *Computers & Education*, 56, 865-872.
- Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology*. London: Sage.
- Tashakkori, A., & Teddlie, C. (2003). *Handbook of mixed methods in social and behavioural research*. London: Sage.
- Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research*. Thousand Oaks, CA: Sage.
- Thibodeau, P. H., & Boroditsky, L. (2011). Metaphors we think with: The role of metaphor in reasoning. *Plos One*, 6(2), 1-11.
- Thomas, P. R., & McKay, J. B. (2010). Cognitive styles and instructional design in university learning. *Learning and Individual Differences*, 20, 197-202.
- Thompson, L. A., Driscoll, D., & Markson, L. (1998). Memory for visual-spoken language in children and adults. *Journal of Nonverbal Behavior*, 22(3), 167-187.
- Tiippana, K., Andersen, T. S., & Sams, M. (2004). Visual attention modulates audiovisual speech perception. *European Journal of Cognitive Psychology*, 16(3), 457-472.
- Toh, S. C., Munassar, W. A., & Yahaya, W. A. (2010). *Redundancy effect in multimedia learning: A closer look*. Paper presented at the Curriculum, technology & transformation for an unknown future, Sydney.

- Tootell, R. B., Silverman, M. S., Switkes, E., & De Valois, R. L. (1982). Deoxyglucose analysis of retinotopic organisation in primate striate cortex. *Science*, 218, 902-904.
- Trigwell, K., & Prosser, M. (1996). Changing approaches to teaching: A relational perspective. *Studies in Higher Education*, 21, 275-284.
- Trigwell, K., Prosser, M., & Waterhouse, F. (1999). Relations between teachers' approaches to teaching and students' approaches to learning. *Higher Education*, 37, 57-70.
- Trochim, W. M. K. (2006). Research methods knowledge base. Retrieved 22 May 2011, from <http://www.socialresearchmethods.net/kb/qualval.php>
- Tufte, E. R. (1983). *The visual display of quantitative information*. Cheshire, Connecticut: Graphics Press.
- Tufte, E. R. (1990). *Envisioning information*. Cheshire, Connecticut: Graphics Press.
- Tufte, E. R. (1997). *Visual explanations: Images and quantities, evidence and narrative*. Cheshire, Connecticut: Graphics Press.
- Tufte, E. R. (2003). *The cognitive style of PowerPoint*. Cheshire, Connecticut: Graphics Press.
- Tufte, E. R. (2006). *The cognitive style of PowerPoint* (2nd ed.). Cheshire, Connecticut: Graphics Press.
- Tumminello, W. (2005). *Exploring storyboarding*. Clifton Park, NY: Thomson Delmar Learning.
- Turner, J. C., & Oakes, P. J. (1986). The significance of the social identity concept for social psychology with reference to individualism, interactionism and social influence. *British Journal of Social Psychology*, 25, 237-252.
- Tversky, B. (2010). Visualizing thought. *Topics in Cognitive Science*, 3, 499-535.
- Ulmer, G. (2003). *Internet invention: From literacy to electracy*. New York: Longman.
- Vallance, M., & Towndrow, P. A. (2007). Towards the 'informed use' of information and communication technology in education: A response to Adams' 'PowerPoint, habits of mind, and classroom culture'. *Journal of Curriculum Studies*, 39(2), 219-227.
- van Merriënboer, J. J. G., & Sweller, J. (2010). Cognitive load theory in health professional education: Design principles and strategies. *Medical Education*, 44, 85-93.
- Vekiri, I. (2002). What is the value of graphical displays in learning? *Educational Psychology Review*, 14(3), 261-312.
- Vigliocco, G., Koustas, S., Vinson, D., Andrews, M., & Del Campo, E. (2013). The representation of abstract words: What matters? Reply to Paivio's (2013) comment on Koustas et al. (2011). *Journal of Experimental Psychology: General*, 142(1), 288-291.
- Vogel, D. R. (1986). *An experimental investigation of the persuasive impact of computer generated presentation graphics*. University of Minnesota, Minnesota.
- Vogel, D. R., Dickson, G. W., & Lehman, J. A. (1986). Persuasion and the role of visual presentation support: The UM/3M study. *MIS RC Working Paper Series, June 1986*.
- Wade, K. A., Garry, M., Read, J. D., & Lindsay, D. S. (2002). A picture is worth a thousand lies: Using false photographs to create false childhood memories. *Psychonomic Bulletin & Review*, 9(3), 597-603.
- Wais, P. E., Rubens, M. T., Boccia, J., & Gazzaley, A. (2010). Neural mechanisms underlying the impact of visual distraction on retrieval of long-term memory. *The Journal of Neuroscience*, 30(25), 8541-8550.
- Wallen, N. E., & Fraenkel, J. R. (2001). *Educational research*. New Jersey: Lawrence Erlbaum.
- Warwick, U. o. (2011). Feedback on learning styles questionnaire. Retrieved 12 October, 2011, from http://www2.warwick.ac.uk/fac/soc/al/learning_english/leap/study_skills/learningstyles/feedback/
- Wasko, J. (2005). *A companion to television*. Malden, MA: Blackwell.
- Weidenman, B. (1989). When good pictures fail: An information-processing approach to the effect of illustrations. In H. Mandl & J. R. Levin (Eds.), *Knowledge acquisition from text and pictures*. Amsterdam: Elsevier.
- Weiss, H., & McGrath, J. B. (1963). *Technically speaking*. New York: McGraw Hill.
- Weissman, J. (2003). *Presenting to win: The art of telling your story*. Upper Saddle River, NJ: Prentice Hall.
- White, L. (2005). *Foundations of basic nursing*. New York: Thomson Delmar Learning.
- Whitehouse, A. J. O., Maybery, M. T., & Durkin, K. (2006). The development of the picture-superiority effect. *British Journal of Developmental Psychology*, 24, 767-773.
- Willard, D. (1973). Absurdity of 'thinking in language'. *Southwestern Journal of Philosophy*, 4, 125-132.
- Williams, M. (2000). Interpretivism and generalisation. *Sociology*, 34(2), 209-224.
- Williams, R. H. (1999). *Secret formulas of the wizard of ads*. North Mankato, MN: Capstone.

- Willingham, D. T. (2005). Do visual, auditory, and kinesthetic learners need visual, auditory, and kinesthetic instruction? *American Educator, Summer 2005*.
- Wilson, M. R., Vine, S. J., Bright, E., Masters, R. S., Defriend, D., & McGrath, J. S. (2012). Gaze training enhances laparoscopic technical skill acquisition and multi-tasking performance: A randomised controlled study. *Surgical Endoscopy, (In Press)*.
- Woolf, V. (1966). *The cinema, Collected essays vol. 2*. London: Hogarth.
- Woolfolk, R. L., Parrish, M. W., & Murphy, S. M. (1985). The effects of positive and negative imagery on motor skill performance. *Cognitive Therapy and Research, 9*, 335-341.
- Wright, J. (2009). The role of computer software in presenting information. *Nursing Management, 16*(4), 30-34.
- Yarbus, A. L. (1967). *Eye movements and vision* (L. Riggs, Trans.). New York: Plenum Press.
- Yates, D. (2006). *Memory tips for math, memorization and learning styles: The successful way to teach K-5 math* (Vol. 2nd). Irvine, CA: Memory Joggers.
- Yilmazel-Sahin, Y. (2009). A comparison of graduate and undergraduate teacher education students' perceptions of their instructors' use of Microsoft PowerPoint. *Technology, Pedagogy and Education, 18*(3), 361-380.
- Young, J. R. (2004). When good technology means bad teaching. *The Chronicle of Higher Education, 51*(12), A30.
- Yue, C. L., Bjork, E. L., & Bjork, R. A. (2013). Reducing verbal redundancy in multimedia learning: An undesired desirable difficulty? *Journal of Educational Psychology, 105*(2), 266-277.
- Zhang, L. F., Sternberg, R. J., & Fan, J. (2013). Revisiting the concept of 'style match'. *British Journal of Educational Psychology, 83*, 225-237.

Appendix 1 Modalities exploratory study: Slide sets

Net-Graphics



Trad-PPT

Some thoughts on communication

- Monkeys spend a lot of time grooming each other
- One fifth of their day is spent this way
- Humans are closely related, but we don't do this
- For our group size, grooming would take up too much of the day
- Instead, we talk to each other – we gossip

1

- As human group size rose, language evolved to replace grooming
- Talking has two main advantages over grooming:
 - It enables you to do other things at the same time

2

- Language allows you to communicate with several others at once
- Language enables those who have seen crucial interactions to tell others about it
- Two thirds of casual communication is gossip

3

- Popular newspapers contain two thirds gossip
- People can't help tuning in to gossip – to stories about other people
- This makes stories a powerful form of communication

4

- Humans differ from other animals in having a larger group size
- Human group size is one hundred and fifty
- The number in social groups is related to brain size

5

- Human Group size is three times that of chimpanzee groups
- Human neocortex is three times the size of a chimpanzee

6

- Humans have smaller groups which contain people close to them
- These are known as Sympathy Groups
- There are ten to twelve in these groups
- Sports teams and cabinets have a similar number

7

- Research shows that over half the impact and perceived truth of communication is based on body language
- A further third based on tone of voice
- Only a small amount on words spoken
- If there is a discrepancy, non-verbal signals will have most impact

8

- People standing close are perceived as warm and likeable
- Standing closer also increases powers of persuasion
- People in your personal space must be alright

9

- In eighteen sixty one a Frenchman named Paul Broca discovered a new area of the brain
- This area listens out for interesting words
- For powerful communication, use stimulating verbs

10

Advertisers call this
'Surprising Broca'

11

- I walked tiredly along the shore
- I trudged along the beach

12

- The waves came in slowly
- The waves limped in

13

- The sky was grey and contained rain clouds
- The sky brooded and threatened rain

14

Opening statement (for Trad-PPt and Net-Graphics)

“Imagine you are standing out here at the front of the room, and facing you is a chimpanzee. You are reaching out with your right arm and holding the hand of your mother; the chimpanzee is reaching out with its left arm and holding the hand of its mother. Your mother is reaching out and holding the hand of her mother, and the chimpanzee’s mother is holding the hand of her mother.

The respective generations are facing each other, and continue in two lines northwards along the M5 onto the M6, going back generation by generation.

By the time they have reached Manchester, they have become one line [pause for several seconds]”.

Appendix 2 Modalities exploratory study: Questionnaires

Post-lecture

Please indicate what you thought of this lecture by circling a number on each scale below

	Poor				Excellent
1. Did you enjoy this lecture?	1	2	3	4	5
2. How would you rate the visual aids?	1	2	3	4	5
3. How appropriate were the visual aids?	1	2	3	4	5
4. How interesting was the information?	1	2	3	4	5
5. How well was it presented?	1	2	3	4	5
6. How easy was it to understand?	1	2	3	4	5

Any other comments?

.....

.....

.....

Thank you for taking part

14 days post-lecture

How much can you remember? *(Please write in the spaces below the questions)*

1. When judging sincerity, what is the relative importance of body language and voice tone compared with the words spoken?
2. What do some scientists believe is the reason behind the evolution of language?
3. What is the average social group size for humans?
4. What are some possible effects of someone we don't know well standing close to us when communicating?
5. What is the social group size for chimpanzees?
6. How much of their day do chimpanzees spend grooming?
7. Who discovered the area of the brain which analyses meaning?
8. What nationality was he?
9. What year did he discover this?
10. In our casual conversations, roughly how much is gossip?
11. What is the technique of using strong words to stimulate listeners known as?
12. What type of words are they?
13. Can you give an example of this technique?
14. How many people on average do we know intimately?

Appendix 3 Lecturers exploratory study: Questionnaire

A) Please circle the answer which best describes how you feel

SA-Strongly Agree / A-Agree / DK-Don't Know / D- Disagree / SD-Strongly Disagree

- | | | | | | | |
|--|--|----|---|----|---|----|
| 1. Using visual aids in the classroom usually improves my teaching | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |
| 2. Pictures as visual aids help learning for children more than for adults | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |
| 3. Visual aids support learning in some subjects better than others | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |
| 4. Visual aids help some types of learners more than others | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |
| 5. Visual aids are of little help for some subjects | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |
| 6. Visual aids provide the most help for learners with a visual learning preference | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |
| 7. Visual aids containing text alone are almost always useful aids to learning | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |
| 8. A well told story can create images in learners' minds as effectively as projected images | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |
| 9. Projecting text based PowerPoint slides improves my teaching | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |
| 10. Text based PowerPoint slides can usefully support any topic I am teaching | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |
| 11. My learners would benefit if I knew more about creating a wider variety of visual aids | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |
| 12. When I learn, it helps me to see visual representations of the topic | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |
| 13. It is difficult to support abstract concepts visually without using text | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |
| 14. I feel I know as much as I need to about the use of visual aids for teaching my subject | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |
| 15. I believe some teachers use visual aids as decoration | <table border="1"><tr><td>SA</td><td>A</td><td>DK</td><td>D</td><td>SD</td></tr></table> | SA | A | DK | D | SD |
| SA | A | DK | D | SD | | |

B) Please circle the answer which you think is most accurate

16. Interactive white boards are so named because they allow interaction between:
- | | | | | |
|-----------------|-----------------|-----------------|------------------|------------|
| Board & learner | Board & teacher | Different media | Board & Internet | Don't know |
|-----------------|-----------------|-----------------|------------------|------------|
17. The minimum pixel height for a graphic to be sharp full-size in PowerPoint is
- | | | | | |
|-----|-----|-----|-----|------------|
| 100 | 200 | 400 | 800 | Don't know |
|-----|-----|-----|-----|------------|
18. What percentage of learners in an average class will have some colour-blindness? (*M*-male, *F*-female)
- | | | | | |
|------------|------------|-------------|--------------|------------|
| 4%M
6%F | 1%M
1%F | 10%M
5%F | 7%M
.05%F | Don't know |
|------------|------------|-------------|--------------|------------|
19. Visual aids supporting a teacher's voice may increase *capacity* of which memory?
- | | | | | |
|---------|-------|-----------|--------|------------|
| Working | Audio | Long-term | Visual | Don't know |
|---------|-------|-----------|--------|------------|
20. How quickly can learners read screen text compared with the speed of speech?
- | | | | |
|---------------|------------|---------------|------------|
| Twice as fast | Same speed | Twice as slow | Don't know |
|---------------|------------|---------------|------------|

C) Please select the answer which best applies to you

21. I have been complimented by learners on my use of projected visual aids
- | | | | |
|-------|--------------|--------|-------|
| Often | Occasionally | Rarely | Never |
|-------|--------------|--------|-------|
22. I am sometimes at a loss to know how to create visual aids that relate to my topic
- | | |
|------|-------|
| True | False |
|------|-------|
23. I sometimes use text visual aids because I can't think of a graphic way to represent my topic
- | | |
|------|-------|
| True | False |
|------|-------|
24. I use text visual aids because that is usually all I have time to prepare
- | | |
|------|-------|
| True | False |
|------|-------|
25. I usually use projected text visual aids because they are all I know how to create
- | | |
|------|-------|
| True | False |
|------|-------|
26. I have successfully inserted pictures into a PowerPoint presentation
- | | |
|------|-------|
| True | False |
|------|-------|
27. I have successfully linked video clips to a PowerPoint presentation
- | | |
|------|-------|
| True | False |
|------|-------|
28. I have created non-text visual aids which support learning of abstract concepts
- | | |
|------|-------|
| True | False |
|------|-------|
29. I would like to know more about visual representation of abstract concepts
- | | |
|------|-------|
| True | False |
|------|-------|
30. I have used presentation software that allowed me to move images around in three dimensions
- | | |
|------|-------|
| True | False |
|------|-------|

D) About you, please select one answer for each

31. Highest Teaching Qualification (please state only qualifications which included teaching practice):

- ☐ ENB 998/997
- ☐ Cert Ed
- ☐ PGCE
- ☐ Introduction to teaching eg City & Guilds 7302
- ☐ Currently undertaking Initial Teacher Training
- ☐ None
- ☐ Other, please indicate

32. Teaching environment (mainly)

- ☐ Work based
- ☐ Voluntary sector
- ☐ FE
- ☐ HE

Appendix 4 Modalities main study: Lecture topic

Organisational Values

Put Patients First

In everything we do, we will view our actions from the perspective of a patient.

Patient care is at the centre of all we do as individuals and as a hospital. If there is anything reasonable we can do to make each patient's experience better, we will do it.

Our Staff Make the Difference

Great staff are key to delivering the best patient care.

We will be clear about responsibility. We will provide the support to ensure staff can take every opportunity to improve their skills. We recognise that every person is different and will ensure that everyone is treated with dignity and respect. Every member of our staff can make a difference.

Leaders that Lead and Listen

The best patient centred care happens where there is clear leadership and an openness to learn.

We will ensure that there is clinical involvement in our decision making. We will encourage openness and honesty, and emphasise the importance of feedback.

As leaders we look to learn and improve, not blame.

Pull Together as One Team

The best patient care depends on great teamwork with all team members fully playing their part.

We know teamwork makes for better care for our patients and a better working environment. We will work closely with our colleagues, our patients, our healthcare partners and the community to deliver the best patient care.

Strive for the Best

The best patient centred care comes from excellence becoming the standard.

We want to continuously improve. We will create flexibility for innovation. We will add value and make the best use of our limited resources. We want the care we offer to be the very best.

Appendix 5 Modalities main study: Event programme

09:00 – 13:00

TIME	TOPIC
09:00	Welcome and Introductions
09:10	Trust Values
09:20	Waste Segregation Inoculation Incidents
09:35	Counter Fraud
09:45	Moving and Handling
10:05	Safeguarding Vulnerable Adults
10:25	Equality & Diversity
10:35	Infection Control
10:50	Coffee Break
11:05	Information Governance
11:25	Conflict Resolution
11:35	Safeguarding Children
12:00	Risk
12:15	Fire
12:30	Major Incident
12:50	Closing questions
13:00	Close

Appendix 6 Modalities main study: *Custom-Graphics*



Slide 1. Put Patients First



Slide 2. Our Staff Make the Difference



Slide 3. Leaders that Lead and Listen



Slide 4. Pull Together as One Team



Slide 5. Strive for the Best

Appendix 7 Modalities main study: *Trad-PPt*

Put Patients First

- In everything we do, we will view our actions from the perspective of a patient.
- Patient care is at the centre of all we do as individuals and as a hospital.
- If there is anything reasonable we can do to make each patient's experience better, we will do it.

Slide for value1. Put Patients First

Our Staff Make the Difference

- Great staff are key to delivering the best patient care.
- We will be clear about responsibility.
- We will provide the support to ensure staff can take every opportunity to improve their skills.
- We recognise that every person is different and will ensure that everyone is treated with dignity and respect.
- Every member of our staff can make a difference.

Slide 2. Our Staff Make the Difference

Leaders that Lead and Listen

- The best patient centred care happens where there is clear leadership and an openness to learn.
- We will ensure that there is clinical involvement in our decision making.
- We will encourage openness and honesty, and emphasise the importance of feedback.
- As leaders we look to learn and improve, not blame.

Slide 3. Leaders that Lead and Listen

Pull Together as One Team

- The best patient care depends on great teamwork with all team members fully playing their part.
- We know teamwork makes for better care for our patients and a better working environment.
- We will work closely with our colleagues, our patients, our healthcare partners and the community to deliver the best patient care.

Slide 4. Pull Together as One Team

Strive for the best

- The best patient centred care comes from excellence becoming the standard.
- We want to continuously improve.
- We will create flexibility for innovation.
- We will add value and make the best use of our limited resources.
- We want the care we offer to be the very best.

Slide 5. Strive for the Best

Appendix 8 Modalities main study: *Min-PPt*

**Put
Patients
First**

Slide 1. Put Patients First

**Our staff
make the
difference**

Slide 2. Our Staff Make the Difference

**Leaders
that lead,
And listen**

Slide 3. Leaders that Lead and Listen

**Pull
together as
one team**

Slide 4. Pull Together as One Team

**Strive for
the best**

Slide 5. Strive for the Best

Appendix 9 Modalities main study: *Guided-Imagery*

Imagery instruction - Value 1:

Put Patients First

'Imagine you are interacting with a patient in some way and you are looking at each other. Now, if you can, move through 180 degrees and imagine that you are now looking through their eyes, back at yourself...what do you see? How are you interacting with them? What is happening in this scene?'

Imagery instruction - Value 2:

Our Staff Make the Difference

'In a different situation now, you are watching yourself interact with another patient or relative. In this situation, what are you doing to 'make a difference'? What is it you are doing that is over and above simply doing your job in a basic way...what is it that is making this patient feel different? Concentrate on that for a moment.'

Imagery instruction - Value 3:

Leaders that Lead and Listen

'I'd like you to think of a leader you know here who does more than simply manage; someone who leads and inspires, someone who listens to their staff and incorporates their thoughts into what she or he does. Imagine them actually leading, look at them, what are they actually doing...to inspire in that situation?'

Imagery instruction - Value 4:

Pull Together as One Team

'I'm going to make an analogy with your team, the larger team you work with in your ward or department. Imagine they are all like ants, working together for the common good, no-one needing to give instructions, because everyone instinctively knows what to do...and does it. What is happening, what can you see?'

Imagery instruction - Value 5:

Strive for the Best

'Imagine you are in a restaurant or café with a friend and you overhear someone behind you say 'You know, those staff at Musgrove really are the best, they strive to give the best care they can, always looking for ways to improve things'. Examine your feelings for a moment. How does hearing this make you feel, to be part of this organisation she is describing?'

Appendix 10 Modalities main study: Post-lecture questionnaire

Name.....

Job title.....

How many Values can you list?

.....

.....

.....

.....

.....

Please indicate what you thought of the 'Values' lecture

How interesting was the content?	Not at all 1	2	3	4	Very 5
Did the visual aids make the lecture more interesting?	No 1	2	3	4	Yes 5
Did the visual aids help you understand the information?	No 1	2	3	4	Yes 5
Did the visual aids make the Values easier to remember?	No 1	2	3	4	Yes 5
Did the visual aids make the Values any more meaningful or real?	No 1	2	3	4	Yes 5
Did the visual aids help you maintain concentration?	No 1	2	3	4	Yes 5
Overall, did the visual aids improve the experience for you as a learner?	No 1	2	3	4	Yes 5

Is there anything you would like to say about the visual aids that were used in this lecture?

.....

.....

Appendix 11 Modalities main study: Post-lecture questionnaire G-Imagery

Name.....

Job title.....

How many Values can you list?

.....

.....

.....

.....

.....

Please indicate what you thought of the 'Values' lecture

	Not at all				Very
	1	2	3	4	5
How interesting was the content?					
Did visualising make the lecture more interesting?	No 1	2	3	4	Yes 5
Did visualising help you understand the information?	No 1	2	3	4	Yes 5
Did visualising make the Values easier to remember?	No 1	2	3	4	Yes 5
Did visualising make the Values any more meaningful or real?	No 1	2	3	4	Yes 5
Did visualising help you maintain concentration?	No 1	2	3	4	Yes 5
Overall, did visualising improve the experience for you as a learner?	No 1	2	3	4	Yes 5

Is there anything else you would like to say about the experience of visualising in this lecture?
Would you have liked actual visual aids to look at instead/as well?

.....

.....

Appendix 12 Modalities main study: Values retention criteria

Values – post-lecture questionnaire

To be judged as recalled accurately, the words in red were required to be present in the answer, and those in blue had to be represented by a recognisable alternative phrase

1 - Put **Patients** **First**

Acceptable alternative: Patients at the centre of everything we do

Not sufficient: Good patient care is essential

2 - **Our Staff** **Make** the **Difference**

Acceptable alternative: We make a difference to patients
Make a difference

Not sufficient: Do your best

3 - **Leaders** that **Lead** and **Listen**

Acceptable alternative: Managers that lead and listen

Not sufficient: Leaders that lead

4 - **Pull Together** as One **Team**

Acceptable alternative: Work together as a team
Work as a team

Not sufficient: Teamwork

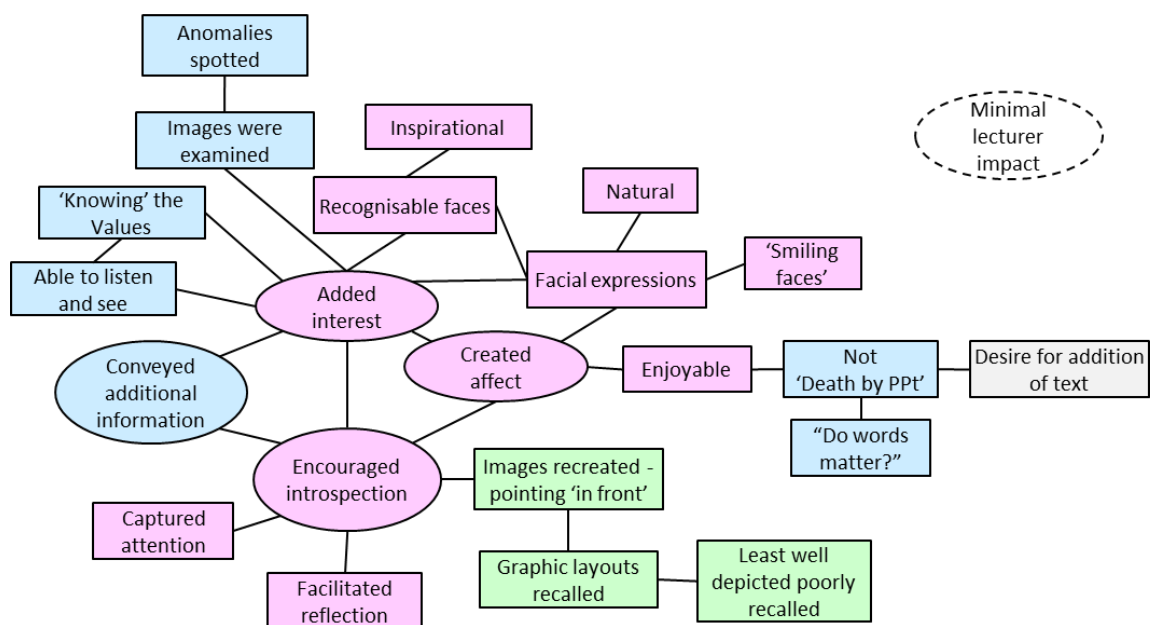
5 - **Strive** for the **Best**

Acceptable alternative: Be the best

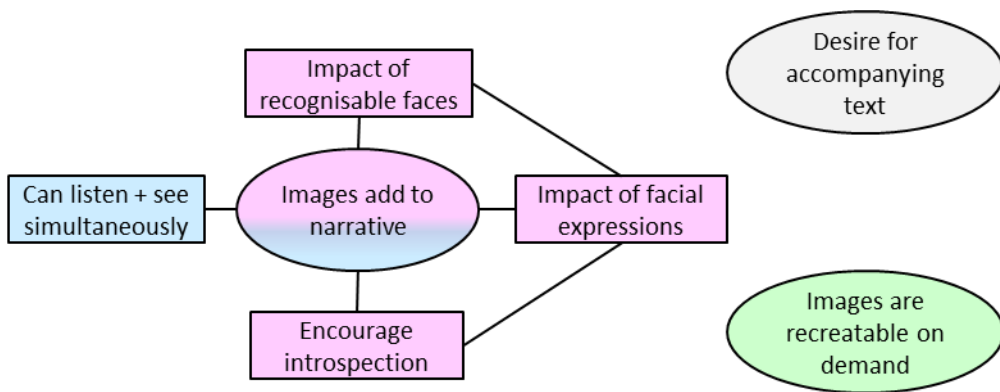
Not sufficient: Be good at what you do

Appendix 13 Modalities main study: Analysis of focus group transcripts

Data extract (Focus Group 5, Custom-Graphics)	Coded for
<p>Participant 2. Yeah, I found them very useful ... I thought it made me think of more ... because going to these lectures, this is my third lecture now because I have been here seven years... and I found this more interesting than the lectures before, because you, like, sit back, people talking to you, and you do... no matter who the person is... will wander, but I found because you're looking visually plus in your mind working, I found it more interesting than I had done in the previous -- it makes you think more about what you do.</p> <p>Participant 4. ...and they made me feel... and I thought, 'I'd really like to work with these people'.</p>	<p>1. Listen & watch simultaneously</p> <p>2. Added interest</p> <p>3. Encouraged introspection</p> <p>3. Encouraged introspection</p>



Modalities main study: Developed thematic map



Modalities main study: Final thematic map

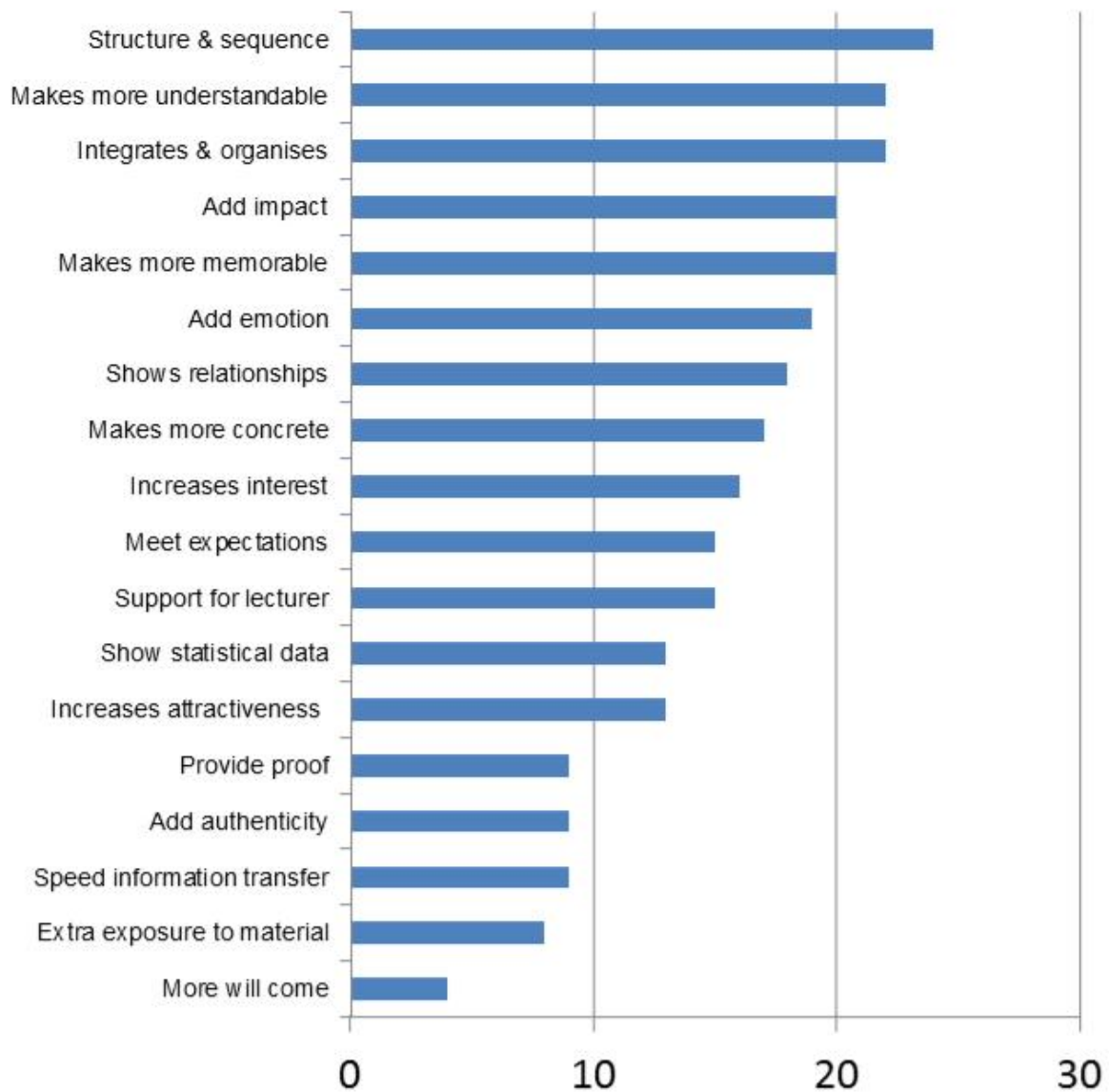
Appendix 14 Lecturers main study: Interview questions

1. How do your visual aids help you?
2. How do your visual aids help your learners? Is there a particular cognitive function you're aiming for?
3. What is the main reason you use visual aids?
4. What does your visual aid content look like?
5. Do you favour one element of content over another?
6. Do you design any of your visual aids with learning styles in mind?
7. How much does text figure in your visual aids?
8. If you use PowerPoint, do you use the templates and backgrounds?
9. How often do you use visualisation [using imagination] rather than visible aids? (that is, over and above everyday metaphorical speech)
10. If you could have creative/professional support to provide visual aids, are there some [types] visual aids you would use that you don't currently?
11. Can you remember what tuition you received specifically about visual aid use when you took your original teaching qualification? Or on how they 'work' with learners?
12. What year did you qualify as a teacher?
13. If I suggest some other reasons why visual aids might be used, could you tell me how important you feel each might be?

Appendix 15 Lecturers main study: Supplementary question

- Makes things more concrete
- Integrates/organises information
- Make things more understandable
- Makes things more memorable
- Increases attractiveness of lesson
- Shows relationships between things
- Increases interest
- Extra exposure to material
- Show statistical data
- Add impact
- Add emotion
- Provide a structure & sequence
- Support for teacher/lecturer
- Meet audience expectations
- Speed up transfer of information (charts, etc)
- Convey [sense of] authenticity
- Provide proof
- More people will [pay to] come

Appendix 16 Lecturers main study: Responses to supplementary question



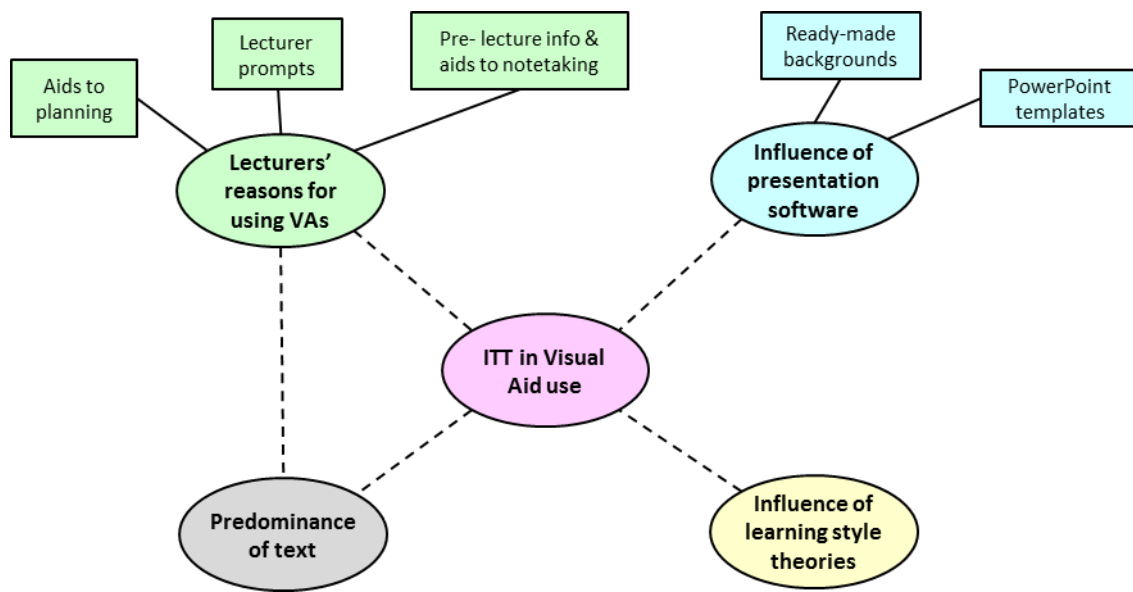
Appendix 17 Lecturers main study: Analysis of interview transcripts

Data extract	Coded for
<p>Daphne it helps me to prepare in my mind before I actually start doing the session and um, what I do with the visual aids is sort of plan the visual aids first and then work the session around that -- because those are the bits that I'll actually make available to the student and so in a way they form my lesson plan and to a large degree my notes as well</p>	<ol style="list-style-type: none"> 1. Lecturer-orientated, prompts during lecture 2. Lecture orientated, lecture planning 3. Visual aid design, text

Data extract, with codes



Developed thematic map



Final thematic map showing five main themes

Appendix 18 Certificate of ethical research approval

STUDENT HIGHER-LEVEL RESEARCH



Graduate School of Education

Certificate of ethical research approval

STUDENT RESEARCH/FIELDWORK/CASEWORK AND DISSERTATION/THESIS

You will need to complete this certificate when you undertake a piece of higher-level research (e.g. Masters, PhD, EdD level).

To activate this certificate you need to first sign it yourself, and then have it signed by your supervisor and finally by the Chair of the School's Ethics Committee.

For further information on ethical educational research access the guidelines on the BERA web site: <http://www.bera.ac.uk/blog/category/publications/guidelines/> and view the School's statement on the 'Student Documents' web site.

READ THIS FORM CAREFULLY AND THEN COMPLETE IT ON YOUR COMPUTER (the form will expand to contain the text you enter). **DO NOT COMPLETE BY HAND**

Your name: Nick Napper

Your student no: 570036033

Return address for this certificate: Apple Tree Cottage, Staple Fitzpaine, Taunton, Somerset. TA3 5SW

Degree/Programme of Study: PhD Education

Project Supervisor(s): Prof Rupert Wegerif, Dr Shirley Larkin

Your email address: nln201@exeter.ac.uk

Tel: 01823 342229 (day)

I hereby certify that I will abide by the details given overleaf and that I undertake in my thesis to respect the dignity and privacy of those participating in this research.

I confirm that if my research should change radically, I will complete a further form.

Signed: date: 2 Nov 2009.

NB For Masters dissertations, which are marked blind, this first page must **not be included** in your work. It can be kept for your records.

Chair of the School's Ethics Committee
last updated: August 2009

Certificate of ethical research approval

Your student no: 570036033

Title of your project: Are text based slides the best we can do? A study into the effects of classroom visual aids on the cognitive processes of adult learners.

Brief description of your research project: Establishment of a typology of visual aid use by means of a series of interviews with teachers and lecturers in university and adult education. This typology will inform a comparative case study of lecture outcomes among a diverse group of health service employees who have experienced lectures supported by either: text based visual aids, graphic visual aids or no visual aids. A comprehensive literature review will discuss findings in the light of current thinking in this area.

Give details of the participants in this research (giving ages of any children and/or young people involved): Participants will be teachers and lecturers for the initial interviews and health service employees attending planned training for the comparative study. There will be no children or young people involved at any stage.

Give details regarding the ethical issues of informed consent, anonymity and confidentiality (with special reference to any children or those with special needs)

All participants involved in initial interviews will be asked to sign a consent form in the style of the SELL consent form, the content of which will also have been verbally explained. Participants will be informed they are under no compulsion to participate and may withdraw their consent at any time. It is not my intention to involve anyone with special needs. In the event of realising I have inadvertently done so (for example when interviewing the lecture attendees), I will adapt the interview to ensure no discomfort for the participant. The only way I anticipate this occurring is if I interview someone who has attended a lecture supported by text slides who has special needs regarding reading. In this event, I will deal sensitively with the situation and neither use or save the data from that meeting.

Give details of the methods to be used for data collection and analysis and how you would ensure they do not cause any harm, detriment or unreasonable stress:

Semi structured interviews recorded on digital voice recorder and transferred to NVivo for analysis. Questionnaires and interviews for lecture outcomes. The information sought is not of a sensitive nature. Some examples of teachers and lecturers' visual aids may be kept and stored in NVivo on personal PC. Participants will be reassured these will be anonymised and not reproduced unless specific permission sought.

The only area likely to cause concern or self consciousness is where teachers use visual aids which they believe to be below an ideal standard and may perceive some discomfort at this coming to light. I will reassure all participants that all results will be anonymised and that I am not looking to discredit, highlight or make any form of judgment on quality.

Give details of any other ethical issues which may arise from this project (e.g. secure storage of videos/recorded interviews/photos/completed questionnaires or special arrangements made for participants with special needs etc.):

All data and voice recorder will be kept in a locked cupboard. Everything stored on a PC will be password protected.

Give details of any exceptional factors, which may raise ethical issues (e.g. potential political or ideological conflicts which may pose danger or harm to participants):

I do not anticipate any exceptional factors.

This form should now be printed out, signed by you on the first page and sent to your supervisor to sign. Your supervisor will forward this document to the School's Research Support Office for the Chair of the School's Ethics Committee to countersign. A unique approval reference will be added and this certificate will be returned to you to be included at the back of your dissertation/thesis.

N.B. You should not start the fieldwork part of the project until you have the signature of your supervisor

This project has been approved for the period: OCT. 2007 until: 30 SEPT 2014

By (above mentioned supervisor's signature):  date: 2nd Nov 2009

N.B. To Supervisor: Please ensure that ethical issues are addressed annually in your report and if any changes in the research occurs a further form is completed.

SELL unique approval reference: 1/09/10/19

Signed:  date: 16/11/2009
Chair of the School's Ethics Committee

This form is available from <http://education.exeter.ac.uk/students/>

